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SURGERY AND THE BASIC SCIENCES

THE APPLICATION OF RECENT CONTRIBUTIONS IN BASIC MEDICAL SCIENCES TO SURGICAL PRACTICE

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MINERAL METABOLISM

MAGNESIUM. Until recent years very little has been known about the symptoms produced by a dietary deficiency of magnesium. In 1932, Kruse, Orent, and McCollum (1) reported that rats maintained on a practically magnesium-free diet exhibited marked vasodilatation and hyperemia of the skin, hyperirritability of the nervous system, cardiac arrhythmia, and finally tetany characterized by tonic-clonic convulsions, which frequently terminated fatally. The erythema served to clearly distinguish this type of tetany from that produced by a reduction of the blood calcium level. Orent, Kruse, and McCollum (2) also demonstrated that dogs, when maintained on a magnesium-free diet, manifested symptoms which differed from those mentioned only to the extent that they were more chronic, and that trophic and nutritional disturbances were accordingly more prominent. A study of the changes in the chemical composition of the blood in such animals (3) revealed a marked fall in the magnesium concentration without detectable changes in the calcium concentration or carbon-dioxide combining power. These findings definitely differentiated magnesium tetany from calcium tetany. The level of cholesterol esters in the blood was observed to be elevated by 100 per cent or more. The bones were found to contain an abnormally high concentration of calcium (4). Brookfield (5), Tufts and Greenberg (6), and Schrader, Prickett, and Salmon (7) have confirmed the finding that animals on a magnesium-deficient diet develop a characteristic tetany. Greenberg, Lucia, and Tufts (8) have studied the changes in kidney function in rats chronically deficient in magnesium. They observed that the animals eliminated an increased volume of urine containing albumin but neither blood nor casts. The blood-protein concentration diminished progressively to the edema level. In the early stages histological examination of the kidneys revealed degenerative changes in the tubules; in the later stages deposits of calcium were identified in the cortex and pyramids. These authors describe these changes as being typically nephrotic. Schrader, Prickett, and Salmon (7) noted mild degenerative changes in the renal tubules, and more severe degeneration in the liver. In the latter organ the cells exhibited a marked foaminess of the cytoplasm. The findings of hypercholesterolemia, reduced blood-protein concentration, edema, albuminuria without hematuria, and degenerative changes in the renal tubules rather closely resemble the findings in clinical lipoid nephrosis; calcification of the kidney is the only discordant finding, but it has not been observed by all investigators.

According to Moore, Hallman, and Sholl (9), magnesium deficiency in calves results in the deposition of calcium in the yellow elastic fibers of the heart, the large blood vessels, and the spleen, and

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in the Purkinje fibers. They consider the possibility that magnesium deficiency may play a rôle in the etiology of arteriosclerosis. Rubin and Rapoport (10) reported that administration of magnesium salts reduces hypertension produced experimentally in rats by ergotamine tartrate.

Magnesium deficiency in man is probably a rare condition inasmuch as this element is widely distributed in food stuffs. Hirschfelder (11), however, has described 10 cases of low blood magnesium in which symptoms of neuromuscular hyperirritability were evident.

Potassium and sodium. In view of the recently discovered importance of potassium and sodium ions in the control of adrenocortical insufficiency, it is of interest to know the possible effects of exclusion of these elements from the diet. Schrader, Prickett, and Salmon (7) have recently investigated the effects produced by a deficiency of potassium in the diet in rats. The animals became lethargic and abdominal distention became progressively more marked. The skin became pale and somewhat cyanotic and the hair short and fur-like. The lethargy progressed to coma and finally death intervened. At necropsy the abdominal cavity showed marked pathological changes. Severe ascites and occasionally hydrothorax and hydropericardium were noted. The intestinal tract was enlarged, congested, edematous, and atonic. Intussusceptions, sometimes as many as four in one individual, were found in the majority of the animals. The kidneys, which were large and pale, showed tubular degeneration. Massive erosions almost perforating the cardiac wall were seen in the ventricles of the heart.

Pathological changes in the eyes were noted by Orent-Keiles, Robinson, and McCollum (12) in rats which had been maintained on a diet deficient in sodium. Corneal ulceration, hypopyon, hemorrhage, bulbar and ciliary injection, and keratinization were found in the eyes of these animals. It was shown that these changes were not related to a Vitamin-A deficiency. The female animals suffered disturbances in the estrus cycle. Kahlenberg, Black, and Forbes (13) have shown that rats on a diet partially deficient in sodium develop anorexia, and fail to grow and store energy-producing materials.

The diets employed in these experiments contained only minute amounts of sodium or potassium; diets deficient to such a degree would probably never be encountered clinically.

Calcium and phosphorus. Calcium and phosphorus, in contrast to the minerals discussed above, are not uncommonly deficient in the ordinary American diet. Day, Kruse, and McCollum (14) have shown that dogs maintained on a practically calcium-free diet develop alternate diarrhea and constipation, edema, osteoporosis with bone deformities, lethargy, and anorexia. Death results from inanition. The blood-calcium level may fall to tetany levels, and acidosis commonly appears.

According to Goss and Kleiber (15) phosphorus deficiency in rats results in retarded growth, impaired appetite, and irregular or absent estrus. In heifers, Kleiber, Goss, and Guilbert (16) reported failure of growth and appetite and impaired efficiency in the utilization of energy, with a marked fall in the blood-phosphorus level.

The usual method of producing experimental rickets has been to feed a diet low in phosphorus, high in calcium, and deficient in Vitamin D. During recent years numerous reports have appeared which demonstrate that the available phosphorus of an adequate diet may be reduced to the rachitogenic level by the addition of certain metallic compounds the phosphate salts of which are insoluble and therefore absorbed only incompletely and with difficulty. The salts of aluminum (Deobald and Elvehjem, 17; Cox, Dodds, Wigman, and Murphy, 18; Jones, 19), iron (17, 18; Brock and Diamond, 20), beryllium (Guyatt, Kay, and Branion, 21; 19), strontium (19), and manganese (Blumberg, Shelling, and Jackson, 22) when incorporated in the diet are capable of producing what has been called "metal" rickets in rats. The development of "metal" rickets may be completely prevented by the addition to the diet of a quantity of phosphates which is more than sufficient to chemically combine with the rachitogenic metallic ion. These findings may be of some clinical interest in view of the practice of administering massive doses of iron for the control of secondary anemia. Probably of even greater significance are the possible undesirable effects which might attend the long-continued administration of aluminum-hydroxide preparations in the treatment of chronic ulcers.

Although low-phosphorus, high-calcium diets have usually been employed for the production of experimental rickets, Shohl and Wolbach (23) have demonstrated that rickets may be produced by a diet the calcium-phosphorus ratio of which have been altered in the opposite direction. In fact, they have shown that a diet with any calcium-phosphorus ratio may become rachitogenic when the absolute amounts of these elements are sufficiently reduced. Shohl (24) has recently reported that to a limited extent a given diet can be made rachitogenic or more rachitogenic by the addition of a mixture of ammonium chloride

and ammonium carbonate in order that the diet have an acid residue. On the other hand, the reverse effects may be produced by the addition of a mixture of citric acid and sodium citrate which maintains an acid reaction in the intestine during absorption and yields an alkaline residue. These results demonstrate the influence of the acid-base balance on the utilization and retention of calcium and the experimental production of rickets. The rôle of Vitamin D is apparently the widening of the non-rachitogenic range of abnormality in the calcium and phosphorus contents of the diet.

Some years ago Albright and Elsworth (25) advanced the theory that the primary action of the parathyroid hormone is to promote the urinary excretion of phosphorus. This effect was found to reach its peak long before the serum calcium became elevated. They suggested that the loss of phosphorus in the urine tends to lower the blood-phosphorus level; that this, in turn, causes the bone salts to dissolve and thus supply excess calcium to the blood. Albright and Sulkovitch (26) have recently suggested that Vitamin D has two physiological actions. Its predominant action is to promote the intestinal absorption of calcium. The second action, which is not anti-rachitic and which becomes manifest only when large doses are administered, is to promote the urinary excretion of phosphorus. This parathormone-like action provided an explanation for the limited usefulness of Vitamin D in the control of parathyroid deficiency. Albright, Bloomberg, Drake, and Sulkovitch (27) have also investigated the mode of action of a new sterol compound chemically related to Vitamin D, which is known as dihydrotachysterol, or A. T. 10. This compound, which is not anti-rachitic, was found to possess to only a slight extent the property of increasing the intestinal absorption of calcium. It was found to be very effective in the promotion of urinary excretion of phosphorus and the elevation of calcium concentration of the blood. On the basis of these results Albright *et al.* explain the effectiveness of the compound in the control of parathyroid deficiencies.

The irradiation of ergosterol gives rise to a series of compounds: lumisterol, tachysterol, Vitamin D, toxisterol, and suprasterols. Only Vitamin D possesses anti-rachitic properties. Toxisterol was a contaminant of certain irradiated ergosterol preparations marketed years ago and this substance was responsible for the marked toxicity of these preparations. Tachysterol can be chemically converted to dihydrotachysterol, a form suitable for peroral administration. It was found by Holtz, Gissel, and Rossman (28) to be very effective and convenient for the control of parathyroid tetany. Numerous favorable clinical reports have appeared mainly in the German literature, which claim the drug to be effective not only in hypocalcemic states, but in a variety of unrelated conditions. (For a complete review and bibliography see Albright *et al.*, 27). Like parathormone the drug manifests toxicity when employed in excessive doses. Presumably the administration of adequate amounts of saline solution should counteract the toxic symptoms of dihydrotachysterol as effectively as those of parathormone (see previous review of this series, 29).

Minerals and hemoglobin formation. Balance studies in man have yielded some interesting information in regard to the retention and utilization of administered iron salts. Fowler and Barer (30) and Brock and Hunter (31) have shown that although large amounts of inorganic iron may be absorbed from the intestines and retained, only a small fraction is utilized in the formation of hemoglobin. McCance and Widdowson (32) have recently reported that parenterally administered iron is not excreted by the intestine. On the basis of this finding they suggest that the intestine does not have the power to regulate iron elimination.

In an earlier review of this series (33) it was mentioned that Beynon (34) had claimed that copper aided hemoglobin regeneration, not by assisting in the conversion of iron to hemoglobin as generally believed, but by preventing constipation and its consequent interference with general nutrition. Black, Kahlenberg, Bratzler, and Forbes (35) have presented evidence which contradicts this assertion. They found that rats on a diet deficient in iron and copper digested more of the ration and produced more heat than control animals which were forced to consume the same quantity of food.

Potter, Elvehjem, and Hart (36) have shown that accelerated hemoglobin production in dogs is accompanied by an increase in the copper concentration in the blood. They also showed that dogs must be included as one of the large number of animals which require copper for hemoglobin regeneration. This finding may necessitate a reinterpretation of Whipple's evidence for the existence of a principle contained in liver which is potent in the treatment of secondary anemia. In 1935 Robscheit-Robbins, Walden, and Whipple (37) assayed various fractions, obtained from liver, kidney, spleen, and cardiac muscle, for their potency in promoting hemoglobin regeneration in dogs rendered chronically anemic by means of frequent bleeding. They found no correlation between the potencies of these various fractions and their total iron content. No distinction be-

tween available and non-available iron was made. They suggested that the constituent of the liver which made it effective in promoting hemoglobin regeneration under these conditions might be an organic compound. Sturgis and Farrar (38) who employed Whipple's method confirmed the fact that liver is more potent than its equivalent in terms of iron. They further demonstrated that whatever the organic constituent of liver might be, it was not contained in casein. They commented on the fact that the animals were receiving additional copper when the liver was being fed, but not when the iron was administered. In view of the fact that dogs apparently require copper and that with Whipple's technique they may very easily be deficient in this element, it cannot be considered established that liver contains an organic principle active in the treatment of secondary anemia. Hart, Elvehjem, and Kohler (39) have shown that the activity of various liver preparations can be accounted for on the basis of their content of iron and copper when the preparations are assayed in rats maintained on a whole milk diet. They conclude that, in the rat whatever active organic constituents may be present in liver must also be present in milk.

It seems to be generally agreed that copper deficiency in adults is so rare that treatment of secondary anemia rarely requires the inclusion of copper supplements. In infants, however, the possibility exists that copper may be of value. Elvehjem, Duckles, and Mendenhall (40) are continuing their studies of this aspect of the problem.

In regard to the rôle of arsenic in the regeneration of hemoglobin, Hove, Elvehjem, and Hart (41) have recently reported that arsenic slightly delays the appearance of anemia in rats which have been placed on a diet deficient in copper, but that arsenic does not augment the effect of iron and copper in correcting this type of anemia. They conclude that if arsenic is necessary for nutrition and hemoglobin formation in the rat, extremely minute traces are sufficient.

A number of diseases in cattle and sheep characterized by severe anemia have recently been shown to be due to a deficiency of cobalt. The administration of cobalt to experimental animals produces a polycythemia. Underwood (42) has detected traces of cobalt in a number of standard iron salts commonly used in the treatment of secondary anemias. In view of these facts, he suggested the possibility that traces of cobalt might be required in man and that the reported superiority of massive doses of iron might be due to traces of cobalt. Kato (43) has reported that iron and cobalt produce prompt remissions in the nutritional anemia of infants. However, Underwood and Elvehjem (44) could demonstrate no effect from the use of cobalt in controlling the anemia of rats maintained on a diet of whole milk. Since the milk contained significant traces of cobalt, they could not definitely eliminate the possibility that cobalt is essential for hemoglobin regeneration. It remains for future investigation to determine the human requirements for cobalt.

Davis (45) has recently reported that liver extracts effective in the treatment of pernicious anemia, but not desiccated hog stomach, are able to correct the polycythemia produced in dogs by cobalt or by strenuous exercise.

WOUND HEALING

It is now well established that the introduction of maggots into a suppurating and poorly healing wound definitely assists in the process of healing. Part of this beneficial effect must be attributed to the fact that the maggots remove necrotic tissue and thus retard the growth and proliferation of pyogenic organisms. Robinson (46) considers that in addition to this action the maggots excrete into the wound some substance which specifically promotes healing of the tissues. By a rather ingenious process of reasoning he concluded that allantoin might be such an active substance. Investigation showed that allantoin is excreted by maggots, and that it greatly promotes the healing of infected wounds. Although no claim was made that allantoin could be completely substituted for maggots, the treatment was effective and its simplicity had much to recommend it. This turned out to be a remedy previously discovered in 1912 by Macalister (47). The latter had reported that infusions of comfrey root, an old home remedy long used by the natives of rural England, promoted the healing of wounds. Analysis revealed that the infusion contained allantoin. Bethune (48) and Kaplan (49) confirmed Robinson's findings in regard to the advantages of the allantoin treatment of suppurative wounds. Continuing his search for active substances which might be excreted by maggots, Robinson (50) subsequently reported that urea in a 2 per cent solution was also efficacious in the treatment of wounds. He attributed the effects to a cleansing action due to the removal of necrotic material and pyogenic bacteria and to a direct promotion of growth and granulation tissue. Symmers and Kirk (51) in 1915, and Foulger

and Foshay (52) in 1935 had previously reported that wound healing was promoted by urea solutions. Millar in 1933 (53) had shown that treatment with urea suppresses the foul odor of sloughing cancerous lesions. It is well known to biochemists that strong urea solutions are excellent solvents for protein material, both natural and denatured. Since Robinson's work appeared several reports have confirmed the value of urea solutions in the treatment of wounds (Holder and McKay, 54; Bogart, 55; Baker, 56; Muldavin and Holtzmann, 57). Most of the later workers agree that concentrated solutions or even crystals of urea are superior to the dilute solution employed by Robinson. The advantages of the method of treatment are its cheapness, simplicity, and its freedom from toxicity and irritation.

An entirely different series of investigations have revealed another source of substances which promote the healing of wounds. In 1934 Loehr (58, 59) reported that the local application of cod-liver oil to first, second, and third degree burns remarkably aids recovery and healing. These findings were quickly confirmed and extended to include various types of lesions, suppurative or not, which tended to heal only with difficulty (Horn and Sander, 60; Strauss, 61; Steel, 62; and others). Since paraffin and other vitamin-free oils were found to be ineffective, it was immediately assumed that the vitamins were responsible for the beneficial effects. The subsequent investigations of Loehr and Unger (63), Loehr, Unger, and Zacher (64); Zacher and Spier (65); and Koch and Engels (66) seem to indicate that the major portion of the activity is to be attributed to the unsaturated fatty acids of these oils. Thus the essential unsaturated fatty acids, previously known as Vitamin F, were implicated in the process of wound healing. Vitamin A is considered to have a synergistic action with the fatty acids; an excess of Vitamin A, however, retards healing.

This subject has recently been taken up by investigators in America, who have come to somewhat different conclusions. Ralli and Brandaleone (67) have studied the effects of local application of cod-liver oil on the rate of healing of wounds experimentally produced in rats which had been maintained on a diet deficient in Vitamin A. In the group of treated animals healing progressed twice as rapidly as in the untreated group. However, analysis revealed no difference in the Vitamin A contents of the livers of the two groups of animals. For this reason it was suggested that although cod-liver oil has a specific effect on the healing process, the active constituent is not Vitamin A. Puestow, Poncher, and Hammat (68) treated experimental burns in guinea pigs and rabbits with tannic acid and with ointments containing various oils having widely varying contents of Vitamins A and D. The vitamin-containing ointments increased the rate of healing by 25 per cent regardless of their content of vitamins. These authors concluded that neither Vitamin A nor Vitamin D could be responsible for the action of the cod-liver oil. Getz (69) has made a careful investigation of the effects of cod-liver oil on the rate of healing of tuberculous ulcers produced in guinea pigs by the intracutaneous injection of tubercle bacilli. The rate of healing was definitely more rapid in 86 animals treated with cod-liver oil than in 89 animals not so treated. This effect could be obtained when the oil was administered locally, subcutaneously, or intramuscularly, but not by the oral route. Paraffin, lanum, olive, and cottonseed oils were found to be inactive. A systemic effect with the cod-liver oil was observed; the treated animals showed less generalized tuberculosis than the controls. Halibut and tuna liver oils were slightly less potent than cod-liver oil in spite of their much higher concentration of vitamins. It was found that the saponifiable fraction of cod-liver oil, which contained the fatty acids, was irritating and suppressed the healing process. The non-saponifiable fraction, on the other hand, caused a much more rapid healing than the whole oil. This fraction also exhibited an enhanced systemic effect against the tuberculosis. From this highly active fraction the heavy sterols were precipitated and found to be inactive. The active principle contained in the remaining vitamin fraction, was shown not to be either Vitamin A or D. This work may yield important results in the treatment of not only badly infected or slowly healing wounds, but also of tuberculosis.

ANATOMICAL NOTES

The fasciæ and fascial spaces of the region of the head and neck are of considerable surgical importance with regard to the routes of spread of infection and the proper incisions for drainage. In view of serious discrepancies in the various earlier descriptions of these structures, Grodinsky and Holyoke (70) have made a new investigation based upon data obtained by study of dissections of and injections into 75 adult cadavers, and serial sections of 1 adult cadaver and 5 fetuses. The

report contains numerous drawings and references to the clinical significance of the findings.

Anson, Wilson, and Gaardsmoe (71) have recently described the form, arrangement, and relationships of the air cells of the petrous portion of the temporal bone of a four-year-old child. Since the description was based on wax-plate reconstructions made to scale from serial sections of the temporal bone, it was possible to demonstrate not only the form of individual cells and of the mass of pneumatized tissues as a whole, but the relations of the assemblage of cells to structures within the temporal bone.

Schunke (72) has contributed a description of the embryological development and the adult structure of the sacro-iliac joint in man.

Ronstrom (73) has investigated in detail the vascular supply of the kidney, based upon dissection and study of corrosion preparations of 54 kidneys taken from subjects varying in age from two to seventy years. McMahon (74) has investigated the anatomy of the ejaculatory ducts and seminal vesicles in over 100 specimens by means of injection technique followed by clearing with a modified Spalteholtz method.

BIBLIOGRAPHY

1. Kruse, Orent, and McCollum. J. Biol. Chem., 1932, 96: 519.
2. Orent, Kruse, and McCollum. Am. J. Physiol., 1932, 101: 454.
3. Kruse, Orent, and McCollum. J. Biol. Chem., 1933, 100: 603.
4. Ibid. 1934, 106: 573.
5. Brookfield. Brit. M. J., 1934, 1: 848.
6. Tufts and Greenberg. J. Biol. Chem., 1938, 122: 693.
7. Schrader, Prickett, Salmon. J. Nutr., 1937, 14: 85.
8. Greenberg, Lucia, and Tufts. Am. J. Physiol., 1938, 121: 424.
9. Moore, Hallman, and Sholl. Arch. Path., 1938, 26: 820.
10. Rubin and Rapoport. Arch. Int. Med., 1937, 59: 714.
11. Hirschfelder. J. Am. M. Ass., 1934, 102: 1138.
12. Orent-Keiles, Robinson, and McCollum. Am. J. Physiol., 1937, 119: 651.
13. Kahlenberg, Black, Forbes. J. Nutr., 1937, 13: 97.
14. Day, Kruse, and McCollum. J. Biol. Chem., 1935, 112: 337.
15. Goss and Kleiber. J. Biol. Chem., 1937, 119: xxxviii.
16. Kleiber, Goss, Guilbert. J. Nutr., 1936, 12: 121.
17. Deobald and Elvehjem. Am. J. Physiol., 1935, 111: 118.
18. Cox, Dodds, Wigman, and Murphy. J. Biol. Chem., 1931, 92: xi.
19. Jones. Am. J. Physiol., 1938, 124: 230.
20. Brock and Diamond. J. Pediat., 1934, 4: 442.
21. Guyatt, Kay, Branion. J. Nutrition, 1933, 6: 313.
22. Blumberg, Shelling, and Jackson. J. Nutrition, 1938, 16: 317.
23. Shohl and Wolbach. J. Nutrition, 1936, 11: 275.
24. Shohl. J. Nutrition, 1937, 14: 69.
25. Albright and Elsworth. J. Clin. Investigation, 1929, 7: 183.
26. Albright and Sulkovitch. J. Clin. Investigation, 1938, 17: 305.
27. Albright, Bloomberg, Drake, and Sulkovitch. J. Clin. Investigation, 1938, 17: 317.
28. Holtz, Gissel, and Rossman. Deutsche Ztschr. f. Chir., 1934, 242: 521.
29. Ivy. Internat. Abst. Surg., 1938, 67: 1.
30. Fowler and Barer. Arch. Int. Med., 1937, 59: 561.
31. Brock and Hunter. Quart. J. Med., 1937, 6: 5.
32. McCance and Widdowson. J. Physiol., 1938, 94: 148.
33. Ivy. Internat. Abst. Surg., 1938, 67: 1.
34. Beynon. Am. J. Physiol., 1937, 120: 423.
35. Black, Kahlenberg, Bratzler, and Forbes. J. Nutrition, 1937, 14: 521.
36. Potter, Elvehjem, and Hart. J. Biol. Chem., 1938, 126: 155.
37. Robscheit-Robbins, Walden, and Whipple. Am. J. Physiol., 1935, 113: 467.
38. Sturgis and Farrar. J. Exper. M., 1935, 62: 457.
39. Hart, Elvehjem, and Kohler. J. Exper. M., 1937, 66: 145.
40. Elvehjem, Duckles, and Mendenhall. Am. J. Dis. Child., 1937, 53: 785.
41. Hove, Elvehjem, and Hart. Am. J. Physiol., 1938, 124: 205.
42. Underwood. Proc. Soc. Exper. Biol. & Med., 1937, 36: 296.
43. Kato. J. Pediat., 1937, 11: 385.
44. Underwood and Elvehjem. J. Biol. Chem., 1938, 124: 419.
45. Davis. Am. J. Physiol., 1938, 122: 397.
46. Robinson. J. Bone and Joint Surg., 1935, 17: 267.
47. Macalister. Boston M. & S. J., 1912, 1: 10.
48. Bethune. J. Thoracic Surg., 1936, 5: 322.
49. Kaplan. J. Am. M. Ass., 1937, 108: 968.
50. Robinson. Am. J. Surg., 1936, 33: 192.
51. Symmers and Kirk. Lancet, 1915, 2: 1237.
52. Foulger and Foshay. J. Lab. & Clin. M., 1935, 20: 1113.
53. Millar. J. Am. M. Ass., 1933, 100: 1684.
54. Holder and McKay. J. A. M. A., 1937, 108: 1167.
55. Bogart. J. Michigan State M. Soc., 1937, 36: 285.
56. Baker. Rocky Mountain M. J., 1938, 35: 310.
57. Muldavin and Holtzmann. Lancet, 1938, 1: 549.
58. Loehr. Chirurgie, 1934, 6: 263.
59. Loehr. Zentralbl. f. Chir., 1934, 61: 1686.
60. Horn and Sandor. Deutsche med. Wchnschr., 1934, 60: 1018.
61. Strauss. Deutsche med. Wchnschr., 1935, 61: 50.
62. Steel. Lancet, 1935, 2: 290.
63. Loehr and Unger. Arch. f. klin. Chir., 1937, 189: 405.
64. Loehr, Unger, and Zacher. Muenchen. med. Wchnschr., 1937, 84: 1859.
65. Zacher and Spier. Zentralbl. f. Chir., 1938, 65: 1155.
66. Koch and Engels. Zentralbl. f. Chir., 1938, 65: 290.
67. Ralli and Brandaleone. J. Nutrition, 1938, 15: 17.
68. Puestow, Poncher, and Hammat. Surg. Gynec., & Obst., 1938, 66: 622.
69. Getz. Proc. Soc. Exper. Biol. & Med., 1938, 38: 543.
70. Grodinsky and Holyoke. Am. J. Anat., 1938, 63: 367.
71. Anson, Wilson, and Gaardsmoe. Arch. Otolaryngol., 1938, 27: 588.
72. Schunke. Anat. Rec., 1938, 72: 313.
73. Ronstrom. Anat. Rec., 1938, 71: 201.
74. McMahon. J. Anat., 1938, 72: 556.

ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

EYE

Birge, H. L.: Cancer of the Eyelids, Conjunctiva, and Cornea. II. Squamous-Cell Epithelioma. *Arch. Ophth.*, 1938, 20: 254.

Squamous-cell epithelioma of the eyelids, conjunctiva, and cornea occurred in 25 per cent of the cases of epithelioma of the eye and its adnexa that were studied. The conjunctival surfaces, including the cornea, gave origin to 37 per cent of the squamous-cell epitheliomas. Primary corneal squamous-cell epitheliomas occurred in 5 per cent of the cases in this series. The malignancy of most of the lesions in the entire series was either of Grade 2 or Grade 3 on the basis of histopathological examination. Chronic irritation or trauma was an etiological factor in 32.2 per cent of the cases.

There was close correlation between the clinical behavior over a period of fifteen years, and the grade of malignancy. Lesions of Grade 1 did not cause death or loss of an affected eye. Lesions of Grade 2 caused loss of the affected eye in 25 per cent of the cases and death in 15 per cent. Lesions of Grade 3 caused loss of the affected eye in 53 per cent of the cases and death in 46 per cent. Lesions of Grade 4 caused loss of the affected eye in all the cases and death in 80 per cent.

The situation of the lesion about the eye or eyelids is of considerable importance, judged by the related percentage of mortality and blindness. Recurrences were frequent in this series. They equaled approximately the number of cases in which malignancy of the lesions was of Grades 3 and 4. The average mortality of all types of epithelioma of the eye and eyelids was about 12 per cent. The mortality and blindness were directly proportional to the histopathological grade of malignancy. Lesions of Grades 3 and 4 were responsible for the largest part of the mortality and blindness.

Given (1) early recognition of the grade of malignancy and (2) treatment proportional with the grade of malignancy, carcinomas about the eye should carry low mortality.

Kronenberg, B.: The Topography and Frequency of Complications of Uveal Sarcoma. *Arch. Ophth.*, 1938, 20: 290.

From 1928 to 1935, 995 eyeballs were examined at the New York Eye and Ear Infirmary. Sarcoma of the uvea was found in 126 (12.8 per cent). These sarcomas, together with 62 other uveal tumors available for study, are the basis of this report.

Sarcoma of the chorioid alone occurred in 164 cases (88 per cent), and with extensions to the ciliary body in 2 cases. The ciliary body alone was involved in 4 cases, the ciliary body and iris in 9, and the iris alone in 9.

Of the 166 sarcomas of the chorioid, 51.7 per cent were located posteriorly, 19.8 per cent anteriorly, and 16.2 per cent equatorially. The largest number (24.7 per cent) occurred in the posterior temporal region, whereas only 4.8 per cent occurred in the posterior nasal region. The temporal zone showed 37.3 per cent while the nasal region was involved in only 13.8 per cent. It appears that most sarcomas of the chorioid occur in the posterior temporal region with consequent early involvement of vision and early diagnosis.

The ages of the patients ranged from fourteen to eighty-four years, averaging fifty-two and six-tenths years. There was no difference as to sex or involvement of either eye. Pigmentation was proved in 76.5 per cent of the sarcomas, but the others were not completely sectioned, and the proportion was probably higher. If sufficient sections are examined it will be found that practically all tumors are pigmented. The opinion expressed by Samuels that all tumors possess a prepigment substance which is converted into pigment by oxidation has gained wide acceptance.

The types of cells were either round, spindle, or mixed. The cells have a different appearance when sectioned at a different angle. Round cells were found in 47 cases, spindle cells in 54, and mixed cells in 41. The rest were not determined.

The determination of the shape is valuable for prognosis. An early tumor is apt to be flat because it is compressed by the lamina vitrea on one side and the sclera on the other. The tumor then grows in the perichorioidal space without meeting much resistance until it reaches the attachment of the ciliary body anteriorly or the zone in which the chorioid is bound to the sclera posteriorly. At this stage it has the shape of a loaf of bread. With further growth it breaks through the lamina vitrea and develops a mushroom growth, later developing into a spherical mass.

Complications which may be encountered are retinal detachment, glaucoma, extra-ocular extension, and necrosis. Retinal detachment occurred in 127 cases, and in 13 of 14 cases in which the tumor was located in the circumpapillary region. Glaucoma is considered to mark the second stage of the growth, being caused by pressure of the subretinal fluid forward against the lens and iris. The site of the tumor did not seem to affect the development of glaucoma.

Extra-ocular extensions occurred along the perforating vessels, from where metastases also occur. Extensions along the vessels were found in 36 per cent, and not found in 61 per cent. In the remaining

cases the question was not determined. The location of the tumor did not influence the frequency of the extensions.

Necrosis occurs as the result of poor circulation. Some cases showed a severe iridocyclitis due to the toxins developed by the tumor.

Metastatic tumors of the chorioid appeared principally in the posterior segments. In 4 of 10 cases they were in the circumpapillary region, in another 4 cases they were in the posterior portion, and in the 2 remaining cases they occupied the entire globe.

The average age of the patients with sarcoma of the iris was forty and three-tenths years, which was lower than that of the group with sarcoma of the chorioid.

EDWARD S. PLATT, M.D.

EAR

Brain, W. R.: Vertigo: Its Neurological, Otological, and Surgical Aspects. *Brit. M. J.*, 1938, 2: 605.

Brain defines vertigo as the consciousness of disordered orientation of the body in space. For consciousness, the orientation of the body in space is normally an orderly, dynamic relation between the bodily schema and the schema of the external world. Vertigo is the state of consciousness which arises when this relation becomes disordered.

Vertigo may arise as a result of a disturbance of function at many different levels. Thus, there can be recognized psychogenic vertigo, vertigo due to cortical disturbances, vertigo of ocular origin, vertigo of cerebellar origin, vertigo due to lesions of the brain stem and to lesions of the eighth nerve, and aural vertigo.

Psychogenic vertigo is usually associated with severe feelings of anxiety and symptoms of overactivity of the sympathetic nervous system. Vertigo may also occur as a conversion symptom in hysteria. An epileptic cortical discharge may cause a feeling of vertigo, as is not uncommon in petit mal. It may arise as a symptom of migraine, or of localized cortical lesions. Other than its association with diplopia, vertigo may occur as a result of a difficulty in adaptation of the posture of the body to an unusual visual environment, such as a rapidly moving train seen from the railway platform.

Vertigo of cerebellar origin does arise, although it is difficult to define the rôle of the cerebellum, especially when the lesion involves the inferior vermis, which is closely linked anatomically with the vestibular system. Vertigo is caused by vascular or neoplastic lesions of the brain stem, but is most striking when disseminated sclerosis involves the pons. Vertigo due to a lesion of the eighth nerve, especially acoustic neuroma, closely simulates aural vertigo as it is associated with deafness and tinnitus. The author does not concern himself with vertigo as a symptom in pathological states of the ear, but confines himself to discussing certain problems associated with Ménière's syndrome.

NOAH D. FABRICANT, M.D.

Hallpike, C. S., and Cairns, H.: Observations on the Pathology of Ménière's Syndrome. *Proc. Roy. Soc. Med.*, Lond., 1938, 31: 1317.

The authors describe the pathological changes in the temporal bones in 2 cases of Ménière's syndrome. Death occurred in both patients shortly after operation for section of the eighth nerve. The surgical factors concerned in the operative failure of these cases are discussed only in so far as they are related to the interpretation of the histological changes.

JAMES C. BRASWELL, M.D.

NOSE AND SINUSES

Cappell, D. F.: The Pathology of Nasopharyngeal Tumors. *J. Laryngol. & Otol.*, 1938, 53: 558.

Cappell reviews the tumor material submitted at the Dundee Royal Infirmary (Scotland), in so far as it concerns the subject of the pathology of nasopharyngeal tumors. During the past eight years 122 new growths from the nasopharynx, tonsils, and pharynx were studied. Sixty-four per cent of the tumors were classified as squamous epithelioma, 10 per cent as lympho-epithelioma and transitional-celled carcinoma, and 8 per cent were parabuccal mixed tumors. Among 4.5 per cent of miscellaneous neoplasms, an example of malignant rhabdomyoma occurred.

Most of the conditions enumerated are too well known to merit special attention. Cappell concerns himself primarily with a discussion of rhabdomyoma and lympho-epithelial tumors. Rhabdomyoma of the soft palate occurs chiefly in childhood or adolescence. It at first appears as a simple tumor and produces symptoms by local effects, such as alteration of the voice, difficulty in speech or in swallowing, or by causing a discharge following ulceration of the surface. When first seen, such growths are likely to present a nodular polypoid structure of white or flesh color. The growth may be sessile, or the whole may be suspended from the mucosa by a thin pedicle. Following simple removal, local recurrence is likely and, in spite of more radical operation subsequently, which may cure the local condition, dissemination by the lymphatics and later by the blood stream appears to be inevitable. The only hope of cure lies in more radical removal of the primary growth and the tissues whence it springs than has yet been attempted in the initial stages of the condition. From the histopathological point of view, the characteristic elements of these tumors are the long tubular and strap-like cells, with parallel sides and strongly acidophile cytoplasm, in which both longitudinal and cross striation is usually demonstrable.

Lympho-epithelial tumors are encountered most frequently in the nasopharynx and tonsils and less often in the hypopharynx. The nasopharyngeal growths give rise to slowly growing tumors of moderately firm consistency in the lateral wall. The most common site is close to the mouth of the eustachian tube, so that unilateral deafness is often

present and may be the first symptom. The primary growth is usually small. For a time the tumor grows expansively and pushes aside neighboring structures, but later, infiltration of the surrounding tissues becomes pronounced. In the late stages the primary growth may attain a large size and give rise to nasal obstruction and difficulty in swallowing and speaking. There is a great tendency toward invasion of the skull base, so that nerve palsies are common. Lympho-epithelial tumors occur at all ages from childhood to old age.

In Cappell's series, the extreme radiosensitivity of these tumors was apparent. Twenty-one patients were observed, 4 of whom had survived for a period of more than five years following radiation therapy, 3 having been treated with radium and 1 with deep x-rays. One other recent case is still under observation. Good local response to radiation was obtained in 6 additional patients, but death took place from intercurrent disease or from metastases, as the site of the local lesion had remained free from recurrence. Emphasis is laid on the absence of harmful results following open biopsy, but further surgical measures are unnecessary and treatment by radiation is the method of choice. NOAH D. FABRICANT, M.D.

MOUTH

Shore, B. R.: Sublingual Epidermoid Cysts. *Ann. Surg.*, 1938, 108: 305.

The author reports 4 cases of true epidermoid cyst arising in the floor of the mouth. Each of the cysts was lined with stratified squamous epithelium; 2 contained hairs or hair follicles. Pre-operative and post-operative illustrations of 1 of these cases are presented with a photograph and a photomicrograph of the specimen. The author discusses the origin of these cysts from fetal remnants in the mesobranchial field and differentiates them from ranulæ. He advocates surgical excision as the treatment of choice.
BRADFORD CANNON, M.D.

PHARYNX

Frank, I.: Papilloma of the Tonsil; with a Report of 3 Cases. *Ann. Otol., Rhinol. & Laryngol.*, 1938, 47: 715.

The author reports 3 cases of hard papilloma of the tonsil, verified by histological examination.

The literature is reviewed and the clinical aspects, and especially the causes of this condition, are discussed. JAMES C. BRASWELL, M.D.

NECK

Pons-Tortella, E., and Broggi-Vallès, M.: An Anatomical Study of the Cellular Spaces of the Neck (Étude anatomique des espaces cellulaires du cou). *Lyon chir.*, 1938, 35: 513.

The authors have attempted in this study to clear up any misunderstanding as to the extent and character of the cellular spaces of the neck. They used

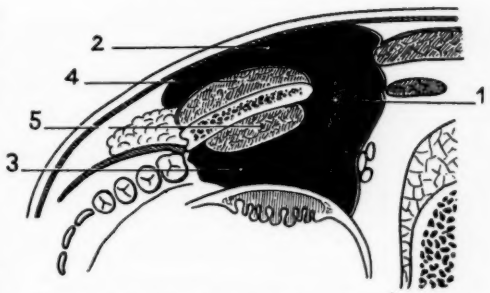

Fig. 1. Schematic drawing of the submaxillary angle space and its prolongations.

materials which solidify after injection and which are opaque to the x-rays. The injections were followed by a study of the roentgenograms and then by anatomical dissection.

The material consisted of 23 cases, both adult and child cadavers, which were without preservation. The cellular spaces were studied with particular reference to their practical importance. In practically all cases, 60 c.cm. of an aqueous suspension of barium sulfate in variable concentrations and tinted vermilion were used. Sometimes plaster-of-Paris was added. Immediately following the injections two roentgenograms were made, one of the sagittal section (Fig. 1) and the other of the transverse view (Fig. 2).

The cellular spaces of the neck were classified as follows, there being 6 main divisions and 14 subdivisions:

Outline of the Cellular Spaces of the Neck

1. Intermaxillary-parotid space and its prolongations

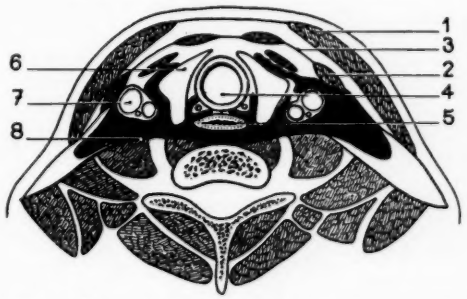

Fig. 2. Schematic drawing showing the arrangement of the deep space of the neck.

1. Sternocleidomastoid
2. Omohyoid
3. Middle aponeurosis
4. Trachea
5. Esophagus
6. Thyroid
7. Neurovascular bundle
8. Prevertebral aponeurosis

a. External superficial suprahyoid
b. Middle space, properly speaking, the intermaxillary-parotid
c. Internal

2. Submaxillary-sublingual space
   a. Submaxillary
   b. Sublingual
3. Deep symmetrical space of the neck (vasculovisceroprevertebral)
   a. Cellular space surrounding the neurovascular bundle
   b. Perivisceral
   c. Supraclavicular
   d. Anterior mediastinal prolongation
   e. Posterior mediastinal prolongation
4. Submuscular space
   a. Constant prolongation toward the supraclavicular region
   b. Indirect prolongation toward the supraclavicular region
   c. Inconstant prolongation toward the middle infrahyoid region
   d. Superior prolongation toward the nape of the neck
5. Infrahyoid space
6. Suprasternal space

RICHARD J. BENNETT, JR., M.D.

Cohn, L. C.: Complete Excision of the Cervical Glands for Regional Metastases. *Arch. Surg.*, 1938, 37: 240.

This study is confined to cases of operable carcinoma in which there was secondary involvement of the cervical glands by metastasis from a primary lesion located in the region of these glands. There were 31 cases operated on between the years 1925 and 1937.

A restricted operation on the cervical glands is often adequate for carcinoma of the lower lip but not in cases of advanced carcinoma of the tongue, floor of the mouth, mucous membrane of the lower jaw, or the jaw itself as the regional lymphatic glands may also be involved (Fig. 1).

The operative mortality in this series of 31 patients was approximately 10 per cent. The author believes that this mortality is far too high and is of the opinion that it can be materially reduced. Twenty-one of the 31 operations were performed with local anesthesia and in these 21 cases the operative mortality was nil.

There seems to be no danger in delaying the operation for a course of pre-operative irradiation when the glands are not palpable, or for the purpose of testing the sensitivity of the tumor to rays when they are palpable.

The patients subjected to this radical operation were patients in whom there was definite metastasis or presumptive evidence of metastasis confirmed by a study of a frozen section at the beginning of the complete excision.

In those patients in whom complete excision of the glands of the neck for unilateral malignant disease was indicated, the operation consisted of excision of the submental lymphatic glands; unilateral excision of the submaxillary lymphatic and salivary glands, and of the occipital, the deep cervical, the paratracheal, the prelaryngeal, the superior anterior cervical, and the infrahyoid lymphatic glands; and resection of the sternocleidosmastoid and the omohyoid muscles, and of the internal jugular vein. A very thorough and technical description of the structures encountered, the normal and pathological tissues removed, and the technique involved are recorded here in detail.

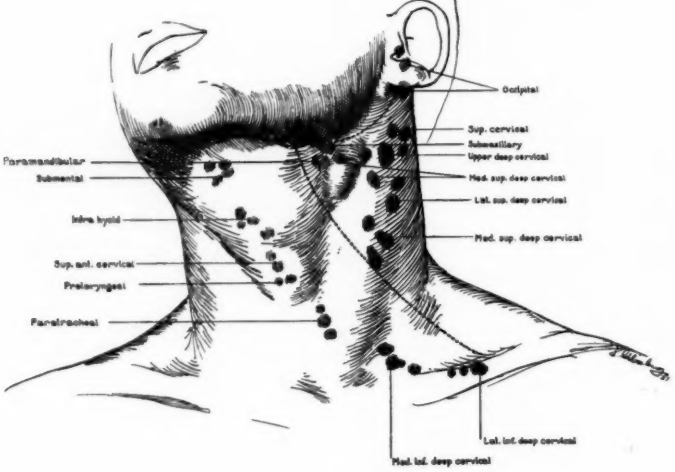

Fig. 1.

Thirty-eight per cent of the patients are living and 62 per cent are dead following this radical procedure. At the time this paper was written, the shortest time a patient was living and well following operation was two and a half months.

The author is of the opinion that had these patients not been subjected to complete excision of these glands with or without irradiation they would not be living and free from recurrence. In regional metastasis in the cervical glands from carcinoma in which the condition is operable, the patient has a chance of good results in 38 per cent of the cases.

RICHARD J. BENNETT, JR., M.D.

Wegelin, C.: The Hypophysis in Basedow's Disease (L'hypophyse dans la maladie de Basedow). *Ann. d'anat. path.*, 1938, 15: 703.

In 20 cases of exophthalmic goiter the hypophysis was examined at autopsy. The morphological lesions of the hypophysis were studied in order to determine whether or not the histological aspects pointed toward a hyperactivity of the anterior lobe in Basedow's disease. There were 11 cases of primary exophthalmic goiter in which no goiter had appeared previously. In the 9 other cases Basedow's disease had developed on the basis of a pre-existing goiter. The author emphasizes the fact that the results of his research do not exclude the possibility that thyrotropic hormone may have some significance in the development of Basedow's disease.

The weight of the hypophysis in Basedow's disease was found to be exceedingly variable. With the exclusion of 2 cases in which adenomas were found, the average weight of the hypophysis in the author's cases was found to be 0.674 gm.

Histological study of the hypophysis in 20 cases of Basedow's disease did not reveal any sign of hyperfunction of the hypophysis. On the contrary, in the anterior lobe there were degenerative lesions of the basophilic cells, as well as of the eosinophilic and the chromophobe cells. There was a certain diminution in the size of the cells, especially in the eosinophilic cells, which was characterized by a cellular dissociation and pericapillary edema and accompanied by a decided hyperemia. It was believed that these lesions were produced by the increase of thyroxin in the blood in Basedow's disease.

In the posterior lobe, the cellular, colloid, and pigmentary "neurocrinie" were generally limited or completely lacking.

The morphological findings in this study do not permit the assumption that a hypophyseal hyperfunction is responsible for Basedow's disease. This finding reaffirms the results of clinical research of other authors who have shown that there is a diminution of the thyrotropic hormone in the blood of individuals with Basedow's disease.

RICHARD J. BENNETT, JR., M.D.

Harris, W., and Klemperer, P.: Pathological Differentiation Between Radiosensitive and Non-Radiosensitive Malignant Neoplasms of the Larynx. *Arch. Otolaryngol.*, 1938, 28: 355.

Harris and Klemperer studied 32 cases of laryngeal carcinoma in which the only treatment was roentgen irradiation according to the principles of Coutard. In the same period they observed 2 sarcomas of the larynx and 1 cylindroma, which also were treated by roentgen rays. All of the lesions occurred on the epiglottis or within the larynx. Twenty of the 32 patients responded favorably to the roentgen therapy; 12 failed to respond.

Biopsy material was studied histologically for criteria for pathological differentiation of radiosensitive and radioresistant neoplasms. In a considerable number of instances the authors found that the histological picture of the biopsy specimen did not fully conform to that of the entire tumor as regards the degree of differentiation and other cytological features. The grade of cellular differentiations, mitotic count, anaplasia of the cells, reaction in the stroma, and the location of the neoplasms were carefully considered.

Observations made by the authors tend to show that there are no pathological criteria, except possibly the number of mitoses, which permit of a differentiation between radiosensitive and radioresistant laryngeal carcinoma if protracted fractional roentgen therapy is employed. This conclusion seems to contradict the accepted belief that radiosensitivity depends largely on the degree of differentiation of the tumor cells.

NOAH D. FABRICANT, M.D.

Orton, H. B.: Cancer of the Larynx: The Immediate and Ultimate Results of Operation in 102 Cases. *Arch. Otolaryngol.*, 1938, 28: 153.

Orton states that early recognition and diagnosis of cancer of the larynx makes possible cure by surgical measures such as laryngofissure, laryngectomy, or lateral transthyroid pharyngotomy.

Since there is recurrence in 50 per cent of the cases of subglottic cancer, total laryngectomy is preferable to laryngofissure in its treatment.

The author is of the opinion that laryngectomy is not a mutilating operation and that laryngectomized patients are not despondent; they are a happy lot, getting a great deal out of life.

JAMES C. BRASWELL, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Young, F. G.: Experimental Investigations on the Relationship of the Anterior Hypophysis to Diabetes Mellitus. *Proc. Roy. Soc. Med.*, Lond., 1938, 31: 1305.

A few years ago our theories on the causation of diabetes mellitus seemed quite complete. Within the past six or seven years, however, experimental work on the anterior lobe of the pituitary gland has revealed facts which are very disturbing to the older theories. In 1931, Houssay showed that the administration of substance from the anterior lobe of the pituitary from hypophysectomized and depancreatomized animals resulted in a very marked increase in the severity of diabetic symptoms. The author confirms this work and discusses at considerable length the possible nature of this "diabetogenic" material and the possible modes of its action.

Dogs were used in the author's series of experiments because they give more consistent results. The pancreas and pituitary glands had not been removed from them as in the animals used in Houssay's experiments. In from three to four days following the daily intraperitoneal injection of a suitable amount of crude saline extracts of fresh anterior pituitary gland, the urine increased in quantity and glycosuria and ketonuria supervened. When the same quantity of extract was continued, the animals lost their diabetic characteristics, but when the quantity was increased the diabetic qualities again became manifest. When this process was continued sufficiently long, the majority of the dogs became permanently diabetic, with the exception that they were able to maintain body weight and did not require the use of insulin.

In his evaluation of this work, the author discusses the influence of the anterior lobe of the pituitary gland on the action of insulin, on the islet tissues of the pancreas, on the glycogen stores during a fast, and the influence of pituitary extracts on ketogenesis. It has been shown that the daily administration of extracts from the anterior lobe of the pituitary gland will markedly lower the hypoglycemic action in rabbits, and that this action is due to a substance which is present in preparations of the so-called lactogenic hormone (prolactin). The author refers to this as "glycotropic substance." The injection of this glycotropic substance definitely decreases the tendency of insulin to increase the liver glycogen level, and inhibits the action of insulin in the peripheral tissues.

It has been shown that the injection of such diabetogenic extracts will result in a true hypertrophy of the islet cells of the pancreas in several types of animals. The fraction that causes this action has not yet been isolated.

With regard to the action on the glycogen stores during a fast, it was found that the administration of glycotropic substance resulted in a definite increase in the liver glycogen content. The reason for this is not at all clear, and it is suggested that there may be less utilization of carbohydrates, or that there might be some glycogenesis from fat.

The administration of substance from the anterior lobe will result in an increase in ketone excretion, though as yet little is known of the nature of the active principle which causes such an increase.

In his discussion of the nature of the diabetogenic factor of the anterior lobe of the pituitary gland, the author points out that at least three factors are necessary for the production of diabetes in the normal dog. The exact nature of these factors is not known at the present time. In referring to the mechanism of the diabetogenic action of the anterior lobe extracts, the author states, "inherent processes of manufacture of sugar in the liver and utilization in the peripheral tissues probably exist, these processes being intrinsic properties of the relevant tissues; the precise mutual adjustment of the rates of these two processes is mediated by the endocrine system, the antagonistic actions of insulin and the pituitary factors playing an important rôle in this adjustment. If this is so, then freedom from diabetes is the result of a precise regulation of the relative potencies of the pancreatic and pituitary factors. If, for any reason, the regulation is faulty so that pituitary effects predominate, then diabetes may result."

JOHN WILTSIE EPTON, M.D.

Coblentz, R. G.: Chronic Subdural Hematoma. *Surgery*, 1938, 4: 194.

Chronic subdural hematoma was first accurately described by Virchow in 1857 under the name of "hematoma duræ matris" or "pachymeningitis hemorrhagica interna." He thought the condition was spontaneous in origin because of a progressive inflammatory condition, and described a vascular subdural membrane, with ecchymosis and subdural hemorrhage. He recognized a traumatic type, chiefly in the newborn. Until 1914 little attention was paid to the condition except to the pathology, and Trotter then stated that the veins passing from the brain to the tributaries of the superior longitudinal sinus are the source of the blood.

Spiller and McCarthy (1899) found experimentally that the new membrane was present in a few days and distinctly formed in five weeks. The lesion is an encysted clot under the dura. At operation it has a characteristic dark greenish-blue appearance, or, in the late stages, it is greenish yellow. When the sac is opened a dark reddish-brown liquid escapes, and clots in various stages of liquefaction may be seen. The inner wall of the sac lies directly over the arachnoid and is not adherent to it except at its

border, particularly in the region of the longitudinal sinus. Upon removal of the sac the brain is flattened and separated one inch or more from the dura. The hemisphere does not expand rapidly to its normal contour ordinarily, and if it does so immediately, a similar lesion is to be suspected on the opposite side.

In the majority of cases a history of a trivial blow on the head can be obtained, usually followed by a brief period with symptoms of concussion. Several days or weeks may elapse before the lesion causes any other symptoms. The first symptom is usually headache, which is persistent, variable, often throbbing, and increases in intensity. Nausea and vomiting may occur. Mental and personality changes occur, and dullness deepens to stupor or coma. Remissions and exacerbations are frequent and striking, the patient passing alternately between coma and consciousness, and possibly acting quite normally when conscious. The neurological picture is one of generalized increased pressure, with rarely any definite focal symptoms. In general it conforms to that produced by a slowly expanding lesion over a large part of one or both hemispheres without local cortical irritation. The slow compression occasionally produces a gradually increasing paresis of the face, arm, and leg, but rarely is there a paralysis. Jacksonian attacks are almost never seen, but convulsive seizures may occur as a late symptom. The pulse is usually slow. The spinal fluid is often under increased pressure, and may be clear or xanthochromic. In the early stages the eye grounds are normal, but later they show venous congestion and gradual obscuration of the margins and total absence of the cups.

The increase in the size of the sac may be due to recurrent bleeding from the originally injured vein or from granulation tissue in the wall of the dura. McKenzie suggested also a process of osmosis, with the sac acting as a permeable membrane.

If a subdural clot is suspected burr openings should be made over both hemispheres. Air injection is seldom necessary, but may be necessary for a differential diagnosis. The simplicity of bilateral perforations allows the evacuation of a bilateral hematoma at one sitting without shock or hemorrhage. When a well organized clot is present a flap operation may be needed for its removal. Drainage is not necessary unless there is fresh bleeding.

Cerebral edema, supposed to be the most important postoperative complication, was not suspected or proved in any of the 14 cases presented. Postoperative extradural hemorrhage is more likely to occur than cerebral edema, especially when there is no increased pressure, and when a dead space persists after the evacuation of the clot. This occurred in 1 case of the series. The most important condition is failure of the compressed brain to expand promptly, and it has been noted frequently. The duration of the lesion is probably a determining factor in the postoperative expansion of the brain.

Of the 14 cases presented, a history of trauma was obtained in 12. There was 1 case with bilateral clots. Two deaths occurred, one after a flap operation, the other following a subtemporal decompression. Choked discs were noted in 5 cases, while in the other 9 the pressure was increased, and in 4 it was xanthochromic. Headache was present in all cases. Mental disturbance was prominent in 10 cases. Vomiting occurred in only 4, coma in 2, and paresis of the cranial nerves and extremities was infrequent.

A flap operation was used in 7 cases, burr openings in 4, and subtemporal openings in 3 cases. The diagnosis in 10 cases was suspected from the history and verified by burr openings. Air injection led to the diagnosis and localization in 4 cases in which other lesions were suspected. Shifting of the pineal gland was seen in 1 case. EDWARD S. PLATT, M.D.

Davidoff, L. M., and Dyke, C. G.: Relapsing Juvenile Chronic Subdural Hematoma. *Bull. Neurol. Inst. New York*, 1938, 7: 95.

Trauma to the head at birth and in infancy is of common occurrence. The diagnosis of subdural hematoma in infancy is easily confirmed by puncture of the subdural space through the anterior fontanel. In spite of this knowledge, the condition often remains undiagnosed. Some of these undiagnosed hematomas may go on to spontaneous recovery, others may calcify, and still others may persist, in spite of the disappearance of symptoms, because they mold the adjacent malleable skull of the child to accommodate their mass. In the last type of case, if a

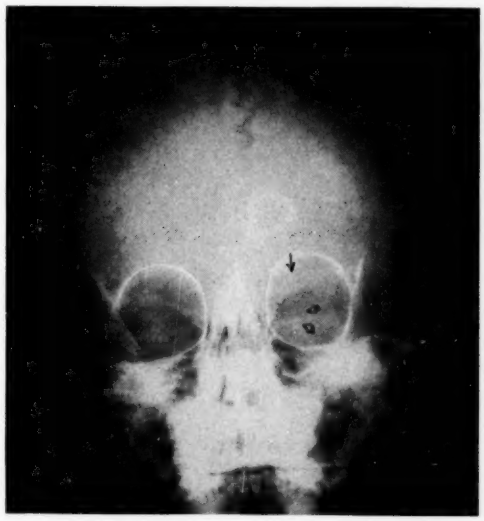

Fig. 1. Left subdural hematoma. Postero-anterior view showing obliteration of oblique line demarcating posterolateral wall of bone orbit, indistinctness of the lateral and inferior wall of the left superior orbital fissure (white arrows) and elevation of left sphenoid ridge (black arrow).

Fig. 2. Same case as Fig. 1. The lateral and third ventricles are displaced to the right. The roof of the right is 1 mm. higher than the left. The left superior orbital plate and ridge and left side of the cribriform plate are elevated (arrows).

trauma to the head occurs later in life, bleeding in the sac of the old hematoma may again occur with recurrence of the symptoms. Further, these cases show advanced bone changes in the skull adjacent to the lesion as a result of the old and original hematoma. The authors present 4 such cases which

Fig. 3. Lateral view showing the downward and forward expansion of the right middle fossa (white arrows). Black arrows demarcate inferior and anterior margins of the left middle fossa. Letter A indicates posteriorly displaced pineal gland.

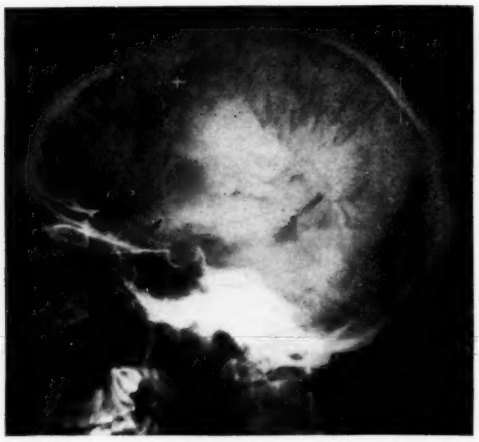

Fig. 4. Same case as Fig. 3. Lateral horizontal encephalogram showing the normal size and shape of the lateral ventricles. The right sphenoid ridge (arrows) is elevated.

they believe constitute a new clinical entity, and which are characterized by the following findings:

1. The individual is young. The ages of the authors' 4 patients were six, fourteen, sixteen, and eighteen years.

2. There is a history of an early trauma which occurred over a period of from five to eleven years before admission of the patients to the hospital.

3. There is a history of a more recent cranial trauma. This occurred two months, five months, six months, and twelve months prior to admission.

4. There is evidence of a moderate increase of intracranial pressure and minimal localizing neurological signs.

5. There is in some cases visible deformity of the skull in some patients. There was a generalized enlargement of the head in one case, and a localized protrusion of the right frontotemporal region associated with ipsolateral exophthalmos in another.

6. The plain roentgenograms show changes in the skull on the side of the lesion, which consisted of the following in the authors' cases:

a. Elevation of the sphenoid ridge (Figs. 1 and 4), superior orbital plate, and superior orbital ridge (Fig. 2).

b. Deepening, widening, and lengthening of the middle fossa (Fig. 3).

c. Disappearance and indistinctness of the oblique line delineating the posterolateral wall of the bony orbit (Fig. 1).

d. Atrophy of the inferior and lateral wall of the superior orbital fissure.

e. Hypertrophy of the frontal and ethmoidal sinuses.

f. Thickening of the skull.

In the pneumoencephalograms the following was seen:

a. Normal sized ventricles.
b. Slight or moderate displacement of the ventricles to the side opposite the lesion (Fig. 2).
c. Relatively slight asymmetry of the lateral ventricles.
d. Relatively slight difference of the roofs of the lateral ventricles.

The skull changes are probably due primarily to increased intracranial pressure by the original hematoma, and secondarily to decreased intracranial pressure subsequent to resorption of the fluid from the sac of the hematoma, which results in hypertrophy of the accessory nasal sinuses and thickening of the cranial vault.

DAVID J. IMPASTATO, M.D.

Kaplan, A.: Subdural Hematoma, Acute and Chronic, with Some Remarks About Treatment. *Surgery*, 1938, 4: 211.

Of the entire group of head injuries, those presenting subdural hematomas most frequently require a critical decision as to whether or not surgical intervention is necessary. The almost uniformly excellent results following operation of chronic subdural hematomas as done in neurosurgical clinics may result in operative procedures being carried out in other cases of head injury with coma in which operation can end only disastrously. The small margin of safety may be adequate if medical treatment is followed, but may not allow the manipulation necessary for radiography and operation.

SUBACUTE DURAL HEMATOMA

Subdural hematomas must be differentiated into acute and chronic phases. Acute subdural hematoma does not exist by itself for there is invariably an associated laceration of the brain as well as a fracture of the skull. There is both arterial and venous bleeding, the blood spreading through the subdural space and the adjoining subarachnoid meshes, with often a fine layer of blood dissecting beneath the pia mater.

Because of the suspended position of the brain in the skull it lags behind at the time of the blow, and it continues to travel forward when the skull stops, thereby striking against the jagged prominences of the base of the skull with resulting laceration of the brain and vascular rupture. Therefore, the most frequent sites of damage are the tips of the temporal and frontal lobes.

Patients with acute traumatic subdural hematomas present symptoms varying with the degree of brain laceration and the associated intracranial bleeding. A single small laceration is accompanied by moderate bleeding into the subdural space, and usually causes immediate unconsciousness followed by signs of recovery in several hours. The best guide to the degree of cerebral trauma is the varying state of the patient's consciousness. Signs of returning consciousness within several hours point to a favorable outcome, and are far more reliable than the pulse or blood pressure readings. Increasing stupor and coma after twenty-four hours usually mean extensive brain laceration, cerebral edema, and massive bleeding, and indicate an unfavorable outlook.

Most cases of acute intracranial injuries are treated best by absolute rest, moderate dehydration, measures combating shock, and judicious lumbar puncture. Compound and depressed fractures and extradural bleeding are conditions which may require surgical intervention. Patients with mild lacerations and small quantities of blood in the subdural space will respond best to the medical treatment alone. Those with extensive brain lacerations and massive subdural hemorrhage are rarely helped by operation, but there are rare cases which may be helped by removal of the blood clot. Of several hundred cases of acute subdural hematoma seen by the author at Bellevue Hospital, New York, there were only 4 which seemed to offer hope of improvement from operation. In only 1 of these was decided improvement noted following operation, and in this case the patient was left with a paresis of the left arm and left homonymous hemianopsia after a surprising recovery. In this case the increase of symptoms after an interval of improvement, and the focal nature of the convulsions were the indications for operation.

CHRONIC SUBDURAL HEMATOMA

This condition occurs more frequently than middle meningeal hemorrhage. It is the result of a relatively mild trauma to the head which displaces the brain in an anteroposterior direction with resulting tear of one or more of the cerebral veins as they enter the superior longitudinal sinus. Slow intermittent and variable bleeding follows the injury, and within from ten to fourteen days a fine membrane, arising mainly from the inner lining of the dura, encloses the blood and gradually forms a cyst wall.

Variations in the tension within the cyst account for the fluctuations in consciousness and explain the variations in the pupil, the paresis, the facial weakness, and the Babinski sign. The presence of hemiparesis, dilated pupil, facial weakness, and the hematoma all on the same side is so constant as to be of diagnostic significance. The dilated pupil is a more constant localizing sign than the paresis. The variations in symptoms are so marked as to be characteristic of chronic subdural hematoma. In a middle-aged or elderly patient the condition is often thought to be a cerebral neoplasm, post-traumatic neurosis, encephalitis, cerebral arteriosclerosis, cerebral thrombosis, or psychoneurosis. The spinal fluid is usually under increased pressure and often xanthochromatic. Bilateral trepanation is often the only way to establish the diagnosis. This procedure is done over the postparietal region, and if a hematoma is not found, ventriculography can be done through the same openings. A well organized hematoma can be removed thoroughly only by a craniotomy.

In 1 patient in whom mental signs developed one week after operation, accompanied by fever, stiff

neck, and weakness of the left arm, meningitis or an overlooked hematoma on the right side was suspected. Improvement followed repeated drainage of blood-tinged spinal fluid, which fact suggested that cerebral edema and the irritative effects of blood in the subarachnoid space might have been causing the symptoms.

In 1 patient with a positive Wassermann reaction rapid and marked fluctuations were observed, and operation was delayed. The pupils were not carefully recorded, probably because of only slight variations due to syphilis. In another patient the course of the hematoma was observed in the hospital. Following the onset of headache and somnolence, diplopia, external rectus weakness, and nystagmus appeared, accompanied by increased pressure of the spinal fluid.

The Ayala index is a valuable indicator of an expanding lesion. It is computed by dividing the final pressure by the initial pressure and multiplying the result by the number of cubic centimeters of fluid removed. Ten or more cubic centimeters of fluid must be removed. An Ayala index below 5 favors the diagnosis of an expanding intracranial lesion. If above 5.5 it indicates a non-expanding lesion. In 1 patient with a coexisting hypertension the index showed the probability of an expanding lesion and operation revealed the presence of a hematoma, the two conditions probably being independent of each other.

The histories and findings in 4 cases of acute and 15 cases of chronic subdural hematomas which came to operation are given in detail.

EDWARD S. PLATT, M.D.

Vincent, C., Hartmann, E., and Delaitre, R.: Recurring Meningeal Hemorrhages in Arterial Angiomas of the Brain (Les hémorragies méningées récidivantes dans les angiomes artériels du cerveau). *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1938, 54: 995.

The authors state that the two most common causes of meningeal hemorrhage are syphilis and arterial hypertension. Recurring meningeal hemorrhages in relatively young individuals, however, are often due to the presence of an arterial angioma of the brain. Most of the authors agree that this condition is characterized primarily by severe headaches, jacksonian attacks, hemiplegia, and the presence of a xanthochromic cerebrospinal fluid.

The authors observed 2 cases, the first that of a young man, eighteen years old, who since the age of ten had suffered from recurrent seizures which were originally diagnosed as epileptic attacks. Examination of the cerebrospinal fluid, however, revealed the presence of meningeal hemorrhage. The attacks recurred at regular intervals and were ushered in by severe headaches, vomiting, and loss of consciousness. During the periods of remission, the patient was completely asymptomatic.

When seen at the clinic, the patient was in delirium and presented a marked cervical rigidity with a slight opisthotonos, and a positive Kernig's sign. The cerebrospinal fluid showed the presence of blood but no leucocytosis. The Wassermann reaction was negative. Following lumbar puncture the patient's condition improved.

The angiogram revealed the presence of an angioma about the size of a small apricot projecting from below the posterior branch of the sylvian artery. The long axis of the tumor was found to run parallel to the sylvian fissure.

The second case was that of a thirty-year-old sailor who experienced the first attack at the age of eight years. Since that time he had experienced several morbid episodes characterized by occipital headaches followed by a left hemiplegia and recurring at about yearly intervals. The angiogram of the brain showed the presence of an arteriovenous hemangioma about 5 by 3½ cm. in size located above the sylvian fissure in the parietal region.

The authors state that the presence of a cerebral hemangioma should always be suspected in young non-hypertensive and non-luetic individuals with a history of recurrent attacks characterized by headaches, jacksonian seizures, and cerebral hemorrhage. According to Cushing and Bailey the pathognomonic signs of cerebral hemangioma are: (1) pulsating exophthalmos, (2) angiomatosis of the facial and cervical blood vessels, and (3) vascular souffle. These signs were absent in the 2 patients studied by the authors. The second patient, however, presented a papilledema suggestive of an increased intracranial pressure.

The authors summarize this condition by stating that cerebral hemorrhages due to cerebral hemangiomas occur in young individuals under twenty years of age. The hemorrhages usually occur at monthly or yearly intervals and are often accompanied by a hemiplegia or by jacksonian crises. A large percentage of these patients present signs of angiomatosis in the face or retinal vessels. These findings are not necessarily accompanied by papilledema. Sometimes these individuals present nevi in other parts of the body and in other cases one of the blood relatives may present a cutaneous angiomatosis.

The final diagnosis is made with the aid of a cerebral angiogram which is performed without danger to the patient if certain precautions are taken. The vascular tumor is usually found to be attached to one of the branches of the internal carotid artery.

RICHARD E. SOMMA, M.D.

Bauer, G.: Nerve Graft in Facial Palsy. *Acta chirurg. Scand.*, 1938, 81: 130.

According to Bauer, the occurrence of facial palsy following operation for mastoid disease cannot be considered uncommon. The paralysis is seldom recognized until the operation has been completed, and the operator seldom realizes the extent of the paralysis until the facial canal is opened at a later operation. Surgical correction of facial paralysis has usually depended upon an anastomosis of the facial nerve with the ninth, eleventh, or twelfth

cranial nerves; plastic operations; or removal of the superior cervical sympathetic ganglion. Anastomosis of the peripheral end of the facial nerve with another cranial nerve may result in the restoration of facial symmetry and ability to close the eye, but there is never a return of involuntary or subconscious emotional movements. Also, the presence of associated movements, such as lifting movements of the shoulders in the spinofacial anastomosis, or rippling movements of the face with each act of mastication, swallowing, or speaking in hypoglossal facial anastomosis are very disturbing. The results of muscle implantation, of neurotization operations, or severance of the cervical sympathetic chain are as discouraging as those of the anastomosis operations.

Ballance and Duel have presented experimental and clinical evidence to show that the best results may be obtained by repair of the damaged facial nerve itself. They have removed the damaged portion of the nerve and replaced it by another nerve taken from some other part of the body. The graft was not sutured, but merely placed between the ends of the divided nerve in the canal.

Bauer describes a case of facial paralysis in a girl of seventeen, which was repaired by the method of Ballance and Duel. The paralysis followed an operation for acute mastoiditis. At reoperation, the facial nerve was seen to be badly damaged at one point within the canal. It was necessary to resect 25 mm. of this nerve and fill in the defect by a graft taken from the lateral femoral cutaneous nerve. Because the nerve was very thin, the graft was laid double and placed between the cut ends of the facial nerve without sutures. The graft was then covered with dentist's gold foil and dressed daily by the technique recommended by Ballance and Duel. The postoperative course was uneventful and the graft was entirely covered by granulation tissue within three weeks. The immediate postoperative treatment consisted of massage, electrical stimulation, and suspension of the angle of the mouth by a hook placed in the corner of the mouth and fastened to the dressing above the ear. Twitching movements were felt in the face two months after the operation, and within one year the patient was able to close her eye and elevate the angle of her mouth about 3 cm. There were no associated movements and the emotional responses were quite symmetrical, although the unaffected side of the mouth would lift higher than the affected side on smiling or laughing.

While the results obtained were not ideal, they were quite satisfactory. DAVID CLEVELAND, M.D.

SPINAL CORD AND ITS COVERINGS

Pool, J. L.: Myeloscopy: Diagnostic Inspection of the Cauda Equina by Means of an Endoscope (Myeloscope). *Bull. Neurol. Inst. New York*, 1938, 7: 178.

The myeloscope is a small endoscope by which the contents of the spinal canal may be visualized. Pool has performed 40 myeloscopies, all limited to the lumbar portion of the spinal canal. As far as can be determined, these cases represent the first living subjects in whom the spinal canal has been examined by a myeloscope. The instrument consists of a small cannula which may be introduced into the subarachnoid space in the same manner as a lumbar puncture needle. The cannula receives a miniature lens and illuminating system, which permit inspection of the nerve roots, arachnoid membrane, and blood vessels of the cauda equina. The procedure causes no more inconvenience to the patient than an ordinary lumbar puncture and so far has not been followed by any deleterious effects.

Fig. 1. Myeloscope assembled for visualization. Note offset light bulb and socket (top of figure); millimeter graduation on barrel of cannula (middle of figure); right angle stop-cock, and eyepiece (bottom of figure). The fork-like device (lower left) is a hinged handle facilitating withdrawal of parts of the instrument from the lumen of the cannula. (Magnification approximately one and one-half times natural size.)

A detailed description of the myeloscope (Fig. 1) and its use are given. The following report is one of five given by the author to illustrate the value of myeloscopy.

A boy fourteen years of age was admitted to the hospital with a history of rapidly progressive weakness of the lower extremities, which began one year prior to his admission, and was followed shortly afterward by loss of sphincter control. At the time of admission he was unable to walk without support. At no period of his illness did he suffer pain or sub-

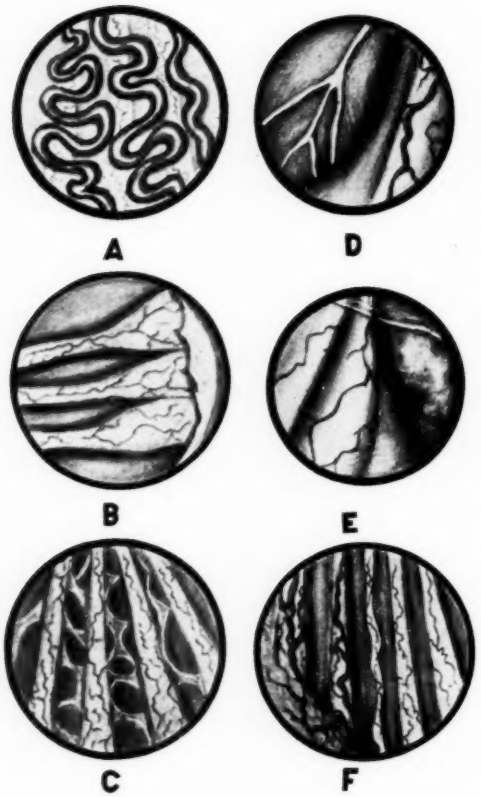

Fig. 2. A. Varicose vessels of cauda equina (red, tortuous structures). Note the three normal nerve roots (straight structures) and their fine blood vessels, lying beneath the varicose vessels. B. Discolored, distorted portion of three nerve roots of cauda equina (at right of field). Note normal appearance of same roots at left of field. At operation an extruded nucleus pulposus was removed from the region of the abnormal roots. The serrated semilunar structure at extreme right represents the edge of the arachnoid membrane (magnified) where parted by the tip of the instrument. It has a thickened, white, opaque appearance which is distinctly abnormal. C. Showing 4 apparently normal nerve roots with intervening "hour-glass" strands; chronic adhesive arachnoiditis. D. Edge of normal nerve root with its blood vessels, at right of field (moderately magnified). At left of field is seen the ovoid mass, partially covered by arachnoid membrane, which is believed to represent extension of a carcinomatous metastasis from the fifth lumbar vertebra. E. Three closely packed, enlarged, edematous looking nerve roots which were found to be heavily infiltrated by metastatic medulloblastoma cells when the patient came to autopsy. At right of field is a granular (dull red) mass representing tumor tissue. Across the top of the field stretches an edge of arachnoid membrane. Its thin, transparent appearance is normal. F. Example of neuritis of two nerve roots of the cauda equina (at left of field). Note dilated vessels and diffusely injected appearance of these roots. At right of field two normal roots with normal vessels are shown. The slightly tortuous (whitish) structure in the center of the field represents the filum terminale. At lower left a small bit of epidural fat may be seen.

jective sensory disturbances. There was no history of significant trauma or illness.

The examination showed spastic paraplegia, absence of the abdominal reflexes, and a sensory level at T-12, more marked for impairment of pain and temperature than for tactile, vibratory, and muscle-joint-tendon perception. There was also an indefinite sensory level at T-8, an automatic bladder, and a loss of rectal sphincter control.

Manometric studies revealed no evidence of subarachnoid block; the cerebrospinal fluid was clear and contained 85 mgm. of protein; the globulin was 2+. Roentgenograms of the spine showed no abnormalities. The blood count, blood, spinal fluid, and Wassermann tests were normal.

The clinical impression was that of intramedullary neoplasm (probably a glioma) of the spinal cord in the lower thoracic region. Varicose vessels of the spinal cord were considered a second diagnostic choice.

The myeloscope was inserted between the spinous processes of L-1 and L-2 without difficulty. The pathology was immediately apparent and consisted of numerous extremely tortuous, enlarged blood vessels which lay free within the subarachnoid space. These vessels extended in both a caudal and a cephalad direction, and were not attached to any of the nerve roots. The vessels were 4 or 5 times the diameter of those supplying the nerve roots (Fig. 2). The roots themselves appeared entirely normal. They were white, non-adherent, and undistorted, and their vascular supply presented no abnormal characteristics.

The condition was diagnosed as varicose vessels of the cauda equina, apparently of congenital type. Presumably these vessels emanate from the thoracolumbar segments of the spinal cord.

Exploratory laminectomy (T-8 to T-11) revealed extensive varicosities of the spinal cord. The varicose vessels coursed in a caudal direction and were undoubtedly continuous with those visualized by myeloscopy. The spinal cord exhibited no evidence of neoplasm. A small collection of clear extra-arachnoid fluid was encountered at the site of laminectomy, but this was apparently not of sufficient proportion to cause spinal-cord compression.

Comment: Accurate pre-operative diagnosis had been made by myeloscopy when other means had failed. DAVID J. IMPASTATO, M.D.

MISCELLANEOUS

Derom, E.: An Experimental Control Study of Vasomotor Surgery of the Extremities (Contrôle expérimental de la chirurgie vasomotrice des membres). *Bruxelles-méd.*, 1938, 18: 1390.

Apparently skeptical of the widespread clinical reports of favorable results of surgery of the sympathetic nerves in vasomotor disease of the extremities, this author reports the effects of these various operations on the reflex vasomotor changes of carotid sinus origin in dogs. On the basis of his experiments he has concluded that carefully performed periarterial sympathectomy has no effect on reflex vasomotor phenomena of such origin. He decries mutilating operations on the peripheral nerves, such as alcohol injections, fascicular dissociation, and crushing between forceps, and believes they have little place in the treatment of any disease, since they are primarily destructive and the beneficial results are at best short-lived. Several forms of operation on the lumbar sympathetic chain were likewise studied. In contrast to Danielopolu, Derom did not find that simple section of the chain between the last lumbar and first sacral ganglion affected the vasomotor responses in the limb of the corresponding side. In order to obtain a complete loss of vasomotor response in the lower extremity, he found it necessary to remove the first, second, and third lumbar ganglia and the intervening chain, or completely to section all communicating rami at these levels. Unilateral adrenalectomy was found to be without effect, a result which by this time should no longer be surprising.

Derom does not attempt to explain clinical results at variance with his experiments. He believes that results are often relative and a matter of degree, and a beneficial effect does not require a maximum vasomotor change. In other words, though a patient may lose a quart of blood at an operation, only a pint of transfused blood may be necessary to save his life; likewise, it isn't always necessary to produce complete vasomotor paralysis in order to save an extremity afflicted with Raynaud's or Buerger's disease. Therefore, operations not entirely sound from a physiological standpoint may sometimes be beneficial enough to warrant their employment.

JOHN MARTIN, M.D.

Brunschwig, A., Humphreys, E., and Roome, N.: The Relief of Paroxysmal Hypertension by Excision of a Pheochromocytoma. *Surgery*, 1938, 4: 361.

The authors present an interesting report of the removal of a rare tumor (paraganglioma), followed by the relief of symptoms. A woman, aged forty-one, complained of "attacks" characterized by constriction in the head, pain in the abdomen, nausea, and often vomiting. This was followed immediately by weakness in the legs and purposeless but controllable movements of the extremities, usually on the right side. Consciousness was not lost. The attacks had become progressively more frequent in the last eight years, and there was a premonition of the attack for one or two minutes.

The history and physical examinations were negative except for a sinus arrhythmia. The normal blood pressure was 146/98. During 2 "attacks" the blood pressure, which was taken almost continuously, rose as high as 270/140 and 236/136 soon after the onset. Intravenous pyelograms were negative, but the retroperitoneal injection of air revealed a rounded mass at the upper pole of the left kidney. A diagnosis of left suprarenal tumor was made. The tumor was removed through the gastric hepatic omentum and the parietal peritoneum. It shelled out easily. Histological study confirmed the preoperative diagnosis. The patient has had no recurrence of the attacks after a period of one year from the time of operation.

Eleven similar cases in which operative treatment was successful are reviewed. These tumors are eventually fatal, but they have a rather characteristic clinical syndrome which should lead to a correct diagnosis and their removal.

ADRIEN VERBRUGGHEN, M.D.

SURGERY OF THE THORAX

TRACHEA, LUNGS, AND PLEURA

Belsey, R.: Extrapleural Pneumothorax. *J. Thoracic Surg.*, 1938, 7: 575.

Although Tuffier in 1891 induced the first extrapleural pneumothorax no serious attention was given to this form of collapse therapy until Graf in 1936 reported on his experiences. Since then numerous reports have appeared in the literature.

Extrapleural pneumothorax was introduced at the Brompton Hospital in London early in 1937 by Roberts to help a large group of patients for whom no other form of collapse therapy seemed possible. This group included early cases too acute for thoracoplasty and in whom intrapleural pneumothorax was impossible, and late cases with lesions too widespread or with a general condition too poor to warrant a thoracoplasty. Further indications were developed but these remained the fundamental ones. Contraindications have been as little understood as the indications, but in general Roberts maintains that extrapleural pneumothorax should never be used when a thoracoplasty can be safely done.

The operation consists in an extrapleural separation of the lung from the chest wall and mediastinum so that it may collapse concentrically toward the hilum. The separation is carried out in the plane between the parietal pleura and the endothoracic fascia, and carried down to such a level that when the floor of the space became straight the pneumothorax would still be sufficiently extensive to prevent the reopening of the collapsed cavity.

In the Brompton Hospital Series general anesthesia was used instead of local. Cyclopropane and nitrous oxide-oxygen-ether proved satisfactory because of the high oxygen concentration made possible, the quietness of the breathing, and the absence of coughing. General anesthesia was preferred to local because of the ability to maintain positive pressure should the pleural space be entered and the whole lung collapse in a patient with low vital capacity, in order to allow rapid enlargement of the thoracic opening should any serious bleeding occur, and finally because it allows one to keep the trachea and bronchi free from secretions by repeated aspirations through a rubber catheter.

The approach to the extrapleural space was made through the bed of the fourth rib after subperiosteal resection of from 2 to 3 in. of its posterior portion. The cleavage plane was developed by blunt dissection with the finger and then under direct vision with the aid of illuminated retractors. For lesions of the upper lobe the pleura was stripped to the level of the seventh or eighth rib posteriorly, the third or fourth rib anteriorly, and to a level below the line joining these points laterally. Freeing of the lobe on all its aspects was essential to success. Airtight closure of the wound in the chest wall was carefully performed.

The first refill of air was given on the day of the operation and another, the next day. A positive pressure of from 10 to 20 cm. of water was produced. Following the first two days the refills were given at intervals increasing a day at a time. After establishment of the pneumothorax the refills were needed only at two or three-week intervals. Maintenance of a positive pressure was considered important. The air was introduced through the first interspace in the midclavicular line.

Patients were strictly kept in bed for from four to six weeks after the operation and then returned to the sanatorium for six months of graduated rest and exercise.

There was minimal operative shock and very little postoperative reaction. Subcutaneous emphysema was constant but of short duration. Serosanguinous effusion developed in all cases but was usually limited and became absorbed spontaneously. Delayed hemorrhage occurred in 4 cases, but was serious in only 1 and in this case was fatal. There was no case of atelectasis of the uncollapsed lower lobe.

Up to the end of 1937 Roberts had performed 33 operations at the Brompton Hospital. Ten early operations were done because of the failure of intrapleural pneumothorax; in 9 of the cases the disease was bilateral. Cavity closure and clinical improvement was obtained in all and the positive sputum disappeared in 7. Of 18 patients with an advanced condition 14 were benefited; in 9 the cavities were closed. Two deaths occurred in this group. In 2 cases only a lateral pneumothorax could be established and in 3 the operation was abandoned because of dense adhesions between the pleura and the chest wall.

Churchill at the Massachusetts General Hospital in Boston has performed the operation on 7 patients with cavity closure in 6 and with no deaths. A tuberculous infection of the extrapleural space occurred in 1 case.

Belsey concludes that extrapleural pneumothorax is a method of obtaining selective and effective concentric relaxation of the lung when other methods have failed and when the patient is too sick for thoracoplasty. Neither the operation nor the postoperative management is a simple procedure and it is not yet known how severe the late complications may be.

RICHARD H. MEADE, JR., M.D.

Wangensteen, O. H.: Thoracoplasty for Tuberculosis and Chronic Empyema Through Short Incisions. *J. Thoracic Surg.*, 1938, 8: 60.

The author has improved his previously reported technique of thoracoplasty by means of short incisions. A great aid in this technique is the use of the notched Semb periosteal raspatory and periosteal raspatories of the author's design.

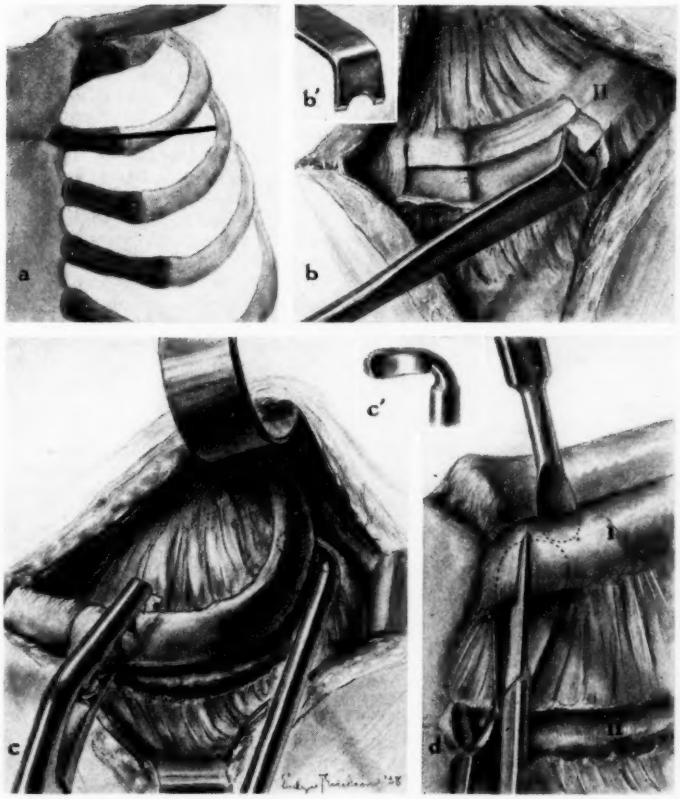

Fig. 1. The technique of rib removal employing sharp periosteal raspatories. (a) The incision for the anterior operation (the skin incision for the posterior operation remains the same as shown in Fig. 1). (b) The Semb periosteal raspatory is used to free the edges of the rib. (c) The cartilage is divided and the raspatories are used to free the upper and lower surfaces of the rib. The intercostal retractor elevates the structures of the chest wall. (d) Manner of liberating the first rib; the division of the cartilage is also shown. Occasionally the first rib cartilage is ossified and must be cut with rib shears. In the performance of anterior extrafascial apicolysis, if the lung is adherent anteriorly its mobilization may be facilitated by rongeuring away more cartilage or even a portion of the sternum.

In the usual procedure, with the patient lying supine, a short incision is made over the second rib anteriorly. The costal cartilages of the first, second, and third ribs are removed with liberal portions of the ribs themselves. A special retractor with a long narrow blade elevates the muscle of the chest wall off the rib during separation from the periosteal bed. At the time of the anterior operation the author does an extrapleural apicolysis. From ten to fourteen days later the residual upper 3 ribs with the transverse processes are removed through a posteriorly placed vertical incision. At the same time the fourth, or even from the fourth to the seventh ribs may be cut and their short angular paravertebral segments removed if desired. These latter ribs are later removed through a short transverse anterior incision. However, these lower ribs are not excised all the way up to the costal cartilage. If 3 lower ribs are to be excised anteriorly 1 oblique incision is made; if 4 ribs are to be removed 2 separate horizontal buttonhole incisions are used.

The author has seen a few instances of dyspnea attending removal of the long segments of the lower ribs by this method, as may occur also by the conventional method. However, the reactions in general are less severe and with the use of sharp perios-

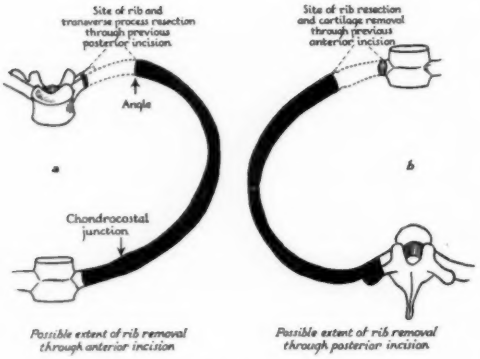
Site of rib and transverse process resection through previous posterior incision
Angle
a
Chondrocostal junction
Possible extent of rib removal through anterior incision
Site of rib resection and cartilage removal through previous anterior incision
b
Possible extent of rib removal through posterior incision

Fig. 2.

teal raspatories bleeding is minimal. No instance of an unfirm anterior chest wall has been noted following this procedure.

The author's technique of extrapleural apicolysis through the anterior incision is as follows: the first and second intercostal muscle bundles together with perichondrium are cut near the sternum. With the tips of the fingers, or with gauze on the fingers or held in a hemostat, pressure is applied along the lower surface of the second and third ribs, and a plane of cleavage is established posteriorly and laterally outside of the endothoracic fascia. Then the endothoracic fascia is similarly separated from the sternum and clavicle. As Sibson's fascia is visualized it is cut. After satisfactory separation of the endothoracic fascia and collapse of the cavity, ribbons of catgut are woven over the depressed dome of lung. Posteriorly the catgut ribbon is anchored as low as possible without tension, usually between the fourth and fifth ribs and anteriorly to the perichondrium in the second intercostal space. A small silver clip attached to the catgut over the summit of the lung facilitates later x-ray determination of the position of the apex. Still an unsolved problem is the proper management of the large extrafascial space.

EARL O. LATIMER, M.D.

Morin, J., Michetti, D., and Dwelshauvers, F.: Superior Topographic Thoracoplasty, Future of the Method: Partial Thoracoplasty and Pneumolysis (La thoracoplastie supérieure topographique, l'avenir de la méthode: thoracoplastie partielle et pneumolyse). *Arch. méd.-chir. de l'appar. respir.*, 1938, 13: 24.

The School of Leysin in Switzerland has sought to limit as far as possible the extent of the surgical intervention in upper partial thoracoplasty. The rib resection is limited to the diseased area, and the exact number and extent of the ribs to be resected are determined before operation by a careful study of the roentgenograms. The collapse obtained should approximate as closely as possible that secured by a successful selective pneumothorax. The use of the muscle-splitting incisions of Picot and Roux and of light formalinization of the posterior periosteum has been of value. The authors consider the retractility of the lesions to be the most important factor in the success of the thoracoplasty.

Altogether there were 106 cases of partial upper thoracoplasty studied. No case in which more than 8 ribs were resected was included and in all there were as many as 4 resected. All patients had open cavities which had not responded to rest treatment and for which intrapleural pneumothorax had not been successful. All operations had been performed by Picot at Lausanne and at Leysin, and by de Rham at Leysin.

After having been followed for from many months to several years 55.7 per cent of the cases were considered to be clinically cured with disappearance of the bacilli in the sputum. Among 9 cases with resection of only 4 ribs the result was good in 7. Among 21 cases with resection of 5 ribs the results were good in 11. The total mortality was 26.4 per cent; the operative mortality, 8.3 per cent. In studying the causes of the operative mortality it was seen that 4.5 per cent of the deaths were attributable to the shock of the operative procedure; the remaining deaths were due to wound infection or to rupture of large subpleural cavities during the operation.

Postoperative pulmonary complications occurred in 23 cases (21.5 per cent) and were fatal in 11. These figures were compared with those of Maurer and Rolland, who reported 36 postoperative complications (21.3 per cent) among 169 cases, 12 of which terminated fatally. Among the 100 patients who survived the operation 70 had had preliminary phrenic paralysis. Of these, 19 (27 per cent) had pulmonary complications, which proved fatal in 11 cases. Among the other patients there were pulmonary complications in 4 (13.2 per cent), with a fatality in 1 of these. Maurer and Rolland found that 47 per cent of their patients with preliminary phrenic paralysis had such complications. The exact nature of the pulmonary changes was not understood, but atelectasis was not considered an important factor.

In a study of the causes of failure the most important factors were considered to be the age of the cavities and the character of the surrounding tissue. The presence of healthy tissue about a cavity, or evidences of retraction, as shown by slanting ribs or upward convexity of interlobar fissure shadows, indicated the likelihood of success. The migration of cavities outside of the zone of collapse can be prevented at times by resection of the first rib being left for the second stage of the operation as suggested by Bernou-Fruchaud. Prolongation of the intervals between stages which permits reossification to take place also accounted for some failures.

The authors consider that sanatorium care should be given patients until their lesions have become stabilized. When thoracoplasty is performed without this preparation the results are not so good.

In a study of the time needed for the sputum to become negative in their successful cases, it was found that in one-half of the cases the sputum became negative within three months, and it was positive in only a very few eight months later. The time needed depended upon the amount of secretion and the age of the cavities.

For cavities encircled by the first rib the value of apicolysis with or without plombage is admitted. Extrapleural pneumothorax can usually secure early good results in the same type of cases which are most amenable to topographical thoracoplasty. When the condition of the patient makes it feasible to use the latter procedure it should always be chosen, as it is permanent and does not expose the patient to the dangers of later re-expansion of the lung or of perforation of the cavity. Because of its relative harmlessness the establishment of an extrapleural pneumothorax can be used in patients too feeble to withstand a thoracoplasty, in patients with active disease, and in bilateral cases. It is also particularly valuable for collapsing cavities in the juxtamediastinal and paravertebral areas.

RICHARD H. MEADE, JR., M.D.

Tsoutis, N. G.: Subperiosteal Thoracoplasty with Apicolysis (Thoracoplastie souspériostée avec apicolyse). *Ann. méd.-chir.*, Par., 1938, 3: 226.

The value of apicolysis for adequate collapse of the lung in pulmonary tuberculosis has been recognized for a long time. In recent cases at the Laennec Hospital in Paris, the importance of the addition of this procedure to radical thoracoplasty has been emphasized in many instances. Tsoutis writes that they believe that apicolysis should be considered during the course of upper partial thoracoplasty when the general condition of the patient during the operation is satisfactory and when the local conditions make it possible. The chance of success is greatest when the cavities are relatively young and are not situated at the periphery. Careful roentgenographic studies should be made in order that the site of the cavity can be localized and also to demonstrate the mobility of the walls of the cavity. A rigid walled cavity at the periphery of the lung usually indicates that apicolysis will be difficult, if not impossible.

Eight case reports are presented. In 4 cases apicolysis was not possible and in spite of extensive thoracoplasties the cavities failed to collapse completely. In the other 4, cavity closure was accomplished after partial upper thoracoplasty with apicolysis, although in 2 of these the mobilization of the apex was incomplete. In 3, disarticulation of the ribs and resection of the transverse processes were considered necessary because of the posterior position of the cavities.

The technique now in use is as follows: after the ribs have been exposed in the usual manner, an incision is carefully made along the upper border of the third or fourth rib, and the fibers of the intercostal muscles are divided. The endothoracic fascial plane is found and separation carried out under the rib just far enough to allow the corner of a compress to fill it and maintain its patency. The rib is then resected subperiosteally, following which procedure apicolysis of the pleural dome is done. When this mobilization has been completed, the upper two or three ribs are resected and the periosteal beds painted with formalin. As the author considers it important to treat the periosteum in this manner, he avoids incising this structure in starting the apicolysis for fear that the formalin may come in contact with the sensitive pleura. The apicolysis should always be attempted at the first stage rather than postponed to a later one, as the cleavage plane is most readily found at that time.

RICHARD H. MEADE, JR.

Graham, E. A.: Clinic on Bronchiectasis. *Surg. Clin. North Am.*, 1938, 18: 1189.

Because of the remarkable progress in the development of thoracic surgery in recent years, bronchiectasis has now become really a surgical disease. The author gives several case reports citing some of the causes of bronchiectasis, after the establishment of the diagnosis treatment is considered.

The treatment of bronchiectasis may be either palliative or radical.

1. Postural drainage is carried out twice daily unless it is required more often to keep the patient from coughing.
2. Frequent instillations of lipiodol are advocated as an adjunct to postural drainage.
3. Bronchoscopy is sometimes necessary to promote better drainage.
4. Pneumothorax was formerly advocated, but has not proved to be very beneficial.
5. Compression by oleothorax, paraffin, and other foreign bodies seems to have no advantage over pneumothorax, and may actually be harmful.
6. Phrenic nerve interruption has been recommended, but there has been no unanimity of opinion that this is successful.
7. Thoracoplasty has been beneficial in some cases.
8. Pneumotomy is of benefit when a fairly large abscess is present.
9. An abdominal belt which produces upward pressure against the diaphragm has been advocated for use in elderly patients.

The author describes operations for the removal of diseased tissue, including his technique for lobectomy.

PAUL MERRELL, M.D.

HEART AND PERICARDIUM

Ingvar, S.: The Diagnosis of Indurative Pericarditis (Zur Frage der Diagnostik der schwieligen Perikarditis). *Acta chir. Scand.*, 1938, 81: 99.

Of the various names applied to chronic pericarditis, such as concretio or acretio pericardii, adhesive pericarditis, mediastinopericarditis, pericarditis calculosa, pericarditis en cuirasse, symphysis cardiaca, and chronic constrictive pericarditis, the author prefers the term fibrous or indura-

tive pericarditis. Simple adhesion between the pericardial layers usually is asymptomatic, and only when the fibrin deposits become organized in the acute stage does the soldering of the pericardial layers into thick fibrous indurations become pathologically significant because they embarrass the cardiac activity and produce the clinical picture of cardiac decompensation, characteristic of the disease. The fibrous process may involve the myocardium or the parietal pericardium and the tissues of the anterior or posterior mediastinum, and attach the heart to the thoracic wall or vertebral column. These variations are only grades of indurative mediastinitis and have no basic significance.

Of 58 patients seen at the Medical Clinic in Lund in whom rheumatic affection clinically complicated pericarditis, one-third died, 12 were left invalids, and 28 were left almost or completely asymptomatic, which results show that rheumatic pericarditis does not always offer a grave prognosis.

The clinical diagnosis is often difficult. Roentgenography does not always give clear pictures in the exudative form, as in the differential diagnosis of myocarditis with marked cardiac dilatation. In such cases a valuable diagnostic aid is aspiration of the pericardium obliquely upward to the left of the xiphoid process next to the insertion of the seventh rib. The cardiac decompensation develops gradually often over a period of years, during which time the acute pericarditis is latent. The pericardial exudate cannot always be aspirated completely and the fibrinous deposits may remain. All cases of acute serofibrinous pericarditis should, therefore, be observed carefully for years for the possible development of indurative pericarditis. Early operation (pericardiectomy), before cardiac decompensation develops, is indicated. When the indurations are incrusted with calcium the coeur en cuirasse is easily seen roentgenographically, but then operation is most difficult and is contraindicated. The diagnosis should be made before this happens.

Because of the long latent period the symptoms are few, such as gradually developing symptoms of general cardiac insufficiency (dyspnea on exertion and cyanosis), palpitation, enlargement of the liver and spleen, and ascites; edema of the lower extremities appears late. A striking picture when the cardiac decompensation has reached its fastigium is the marked filling of the venous system, pronounced cyanosis, and very prominent veins in the neck and the arms. This condition may last for years. As the heart is surrounded by indurations it cannot dilate in the decompensative process, which gives this condition its most important characteristic—a small, quiet heart in marked contrast to the severe decompensation. There is also the so-called pulsus paradoxus (disappearance of the pulse on inspiration with recurrence or increased amplitude on expiration). The increased venous pressure is the earliest and most constant symptom, whereas the arterial blood pressure is usually low, with low amplitude. Besides the calcareous incrustation of the pericardial layers, roentgenography reveals rigid cardiac contours and complete or partial absence of pulsations of the left and right contour of the heart. The size of the heart varies according to whether or not cardiac dilatation is present.

Pericardiectomy has given marked and prolonged relief to many patients even after many years of severe cardiac decompensation. Whenever symptoms of venous stasis develop, pericardiectomy should be considered. A more intimate co-operation between physicians and surgeons will lead to more favorable operative results. LOUIS NEUWELT, M.D

Tengwall, E.: Indurative Pericarditis and Its Operative Treatment (Die schwielige Perikarditis und ihre operative Behandlung). *Acta chir. Scand.*, 1938, 81: 118.

In cases of indurative pericarditis co-operation between the internist and surgeon is necessary, not only for the diagnosis, but also for the best possible preparation of the patient before the operation in order that cardiac complications and edema can be prevented, as well as for the postoperative care of the heart.

Of the 6 patients with indurative pericarditis operated upon by the author, 3 showed calcareous incrustations in the pericardium and an unfavorable course. However, 3 patients with indurative pericarditis without calcareous deposits were restored to health and rendered capable of work although they were invalids before the operation. Operative intervention in patients with calcareous incrustations should be weighed carefully when the roentgenogram shows deposits on the anterior or posterior aspect of the heart. Possibly, the outlook is better when the anterior pericardium is free of calcium and is easily separable and only the posterior aspect of the heart is fixed in a calcium-incrusted pericardium, as the myocardial injuries are not as great and the heart can recover more easily. On the other hand, the operative results in the patients with indurative pericarditis with concretion of the pericardium and without calcium deposits were much better. In the final analysis the result of the operation depends upon the extent of injury to the myocardium and the ability of the heart to overcome the effects of operation with suitable after-treatment. Much also depends upon how far the surgeon ventures in the separation of the pericardium. In order that the ascites and edema be reduced, it is necessary that the ostia of both veins into the heart be mobilized as much as possible.

The thoracotomy was done according to the method of Schmieden: resection of the cartilages of the third to the fifth ribs and of about 2 cm. of the ribs and also of just as broad a strip from the left sternal portion. The separation of the pleura was usually easy. The pericardium was then incised after the proper border between it and the heart was found. This is easy if the pericardium is not incrusted with calcium. The operation is easily done under local anesthesia.

Subsequent to this publication the author operated upon a seventh patient having an old cardiac lesion with symptoms for three years. The heart and liver were both enlarged with ascites. Roentgenography revealed a narrow lime shale on the anterior and posterior aspects of the heart, approximately corresponding with the entries of the venæ cavæ. Four months after operation the patient was subjectively benefited. Possibly no fully satisfactory result can be expected in cases in which some organic cardiac lesion with enlargement of the heart is present. LOUIS NEUWELT, M.D.

ESOPHAGUS AND MEDIASTINUM

Le Fort, R., and Decoulx, P.: Bullets in the Heart and Mediastinum. Late Results in 55 Cases after More than Twenty Years (Projectiles du coeur et du médiastin. Résultats éloignés de 55 cas après plus de 20 ans). *J. de chir.*, 1938, 52: 1.

There have been many controversies among surgeons concerning the immediate and late dangers of, and the indications for, extraction of bullets penetrating the thoracic cavity.

These statistical observations refer to a series of 100 cases which occurred during the war and in which operation had been performed. In this series the mortality following surgical intervention was found to be 7 per cent.

In a follow-up study of these cases, only 55 patients could be traced and they presented the following distribution of thoracic bullet wounds: heart, 7 cases; pericardium, 7 cases; superior mediastinum and region of the large vessels at the base, 8 cases; pulmonary root, 13 cases; posterior mediastinum, 7 cases; and prevertebral region, 9 cases; in 4 cases the bullets were not extracted.

From a detailed study of these records, the following practical conclusions may be drawn:

Non-extracted bullets of the thoracic cavity produce an average incapacitation of 35 per cent; whereas extracted bullets produce an average incapacitation of only 24 per cent. The proportion of complete recoveries was 25 per cent in the cases in which the bullets were not extracted, and 57 per cent in cases in which they were extracted. These figures clearly show that surgical intervention for bullet extraction should be considered whenever possible and should be given preference over any conservative method.

It was found also that the extraction of bullets from the mediastinum was prognostically somewhat more favorable than the extraction of bullets from the heart. Among the mediastinal bullets, the most serious are those which involve the pulmonary root. In general, the following distribution of percentage incapacitation was found for the various bullet wounds involving the thoracic cavity: heart, 30 per cent; pericardium, 14 per cent; great blood vessels, 22 per cent; pulmonary root, 31 per cent; posterior mediastinum, 26 per cent; and prevertebral region, 17 per cent.

It is interesting to note that the most commonly encountered functional disturbances were of respiratory origin for all types of lesions. In the majority of the cases the most common sequelæ were pleuropulmonary manifestations, pulmonary sclerosis, emphysema, and respiratory insufficiency. Even in cases in which the lesion involved the myocardium, pericardium, large vessels, or the cardiac nervous plexus, the circulatory system was surprisingly little affected. The most commonly encountered late sequelæ also involved the respiratory system.

In spite of these findings, the problem of the indications for surgical intervention still remains open to further investigation. It should be noted, however, that bullets in the heart which have not been extracted frequently cause sudden fatal accidents, sometimes twenty or more years following the trauma. The most common accidents in this respect are embolism, thrombosis, aneurysm, and sudden syncope.

The electrocardiograms from individuals in this series from whom the bullet was surgically extracted were invariably normal, or nearly so, twenty years after the original trauma. RICHARD E. SOMMA, M.D.

Phillips, C. E.: Mediastinal Infection from Esophageal Perforation. *J. Am. M. Ass.*, 1938, 111: 998.

Mediastinitis due to perforation of the esophagus has in the past been considered a fatal condition usually.

This author presents a series of 20 cases of mediastinal infection from esophageal perforation, and reports 3 deaths, all of which occurred under different circumstances and might have been prevented.

The esophagus is composed of soft structures and its vulnerability to perforation is, therefore, very striking. After perforation has occurred, the constant motion of the mediastinal structure predisposes to a rapid dissemination of infection. Perforations of the esophagus occur for the most part in its upper portion, and are usually followed by infection. Once infection is liberated in the periesophageal spaces of the neck, the course of spread depends on the amount and virulence of the infective material.

When the infection is relatively small, it may remain localized in the neck for some time and then gradually descend into the superior mediastinum and along the great vessels in the base of the neck. This course of extension explains the lateral swelling of the base of the neck.

The diagnosis of mediastinal infection from esophageal perforation must be made promptly and the abscess accurately localized to assure success in treatment. The following are the important diagnostic points:

1. A history of injury following the swallowing of some sharp substance, or of perforation during instrumentation.

2. Immediate pain, tenderness, and difficulty in swallowing, followed later by fever, swelling, and subcutaneous emphysema.

3. X-rays may show a foreign body, emphysema, or irregularities in the presence of a barium opaque meal.

4. Endoscopic examination may show the perforation.

The spread of the infection is varied: (a) it may slowly perforate an injured mucosa, and later the mediastinum; (b) a virulent infection with a minimum of trauma may set up active mediastinitis; (c) a minute perforation may remain walled off from the mediastinum until the opening into the esophagus closes and then a fulminating mediastinitis results; (d) a wide opening in the mediastinum leads to rapidly spreading emphysema and mediastinitis.

The penetration of infection into the great blood vessels, resulting in septicemia, is the chief threat to life. Serious secondary hemorrhage occurred in 2 of the author's patients, 1 of whom recovered. A slough of the internal jugular vein occurred, in 1 case, with recovery. A slough of a part of the esophagus occurred in 1 case, followed by hemorrhage and death. The thoracic duct was injured in 1 case, but recovery followed. One death resulted from a double pneumothorax. Another was due to infection, principally because the patient refused early operation.

The surgical treatment has for its objectives:

1. Localization of the lesion.
2. Surgical approach; evacuation of the abscess.
3. Release of pressure.
4. Sterilization of the abscess cavity with a diluted solution of sodium hypochlorite.
5. Continued disinfection until healing is complete.

Infection in the retropharyngeal and superior mediastinal spaces is treated by an incision along the anterior border of the sternocleidomastoid muscle. The muscles are separated and the lower pole of the thyroid is elevated, which procedure gives easy access to the superior mediastinal spaces. About 3 Dakin tubes are placed on each side of the esophagus, with care not to cause undue pressure on the pleura. Irrigation is done every two hours until the infection subsides.

When the infection is in the posterior mediastinum, the surgical attack should be made from the dorsum. Two inches of the posterior end of two ribs below the point of perforation are resected, the pleura is displaced outward, and access is obtained to the posterior mediastinum. When barium sulfate has been used in localizing the abscess, and this barium sulfate is encountered in the field of operation, the Dakin tubes are placed immediately and the wound is closed to the tubes. In all cases of mediastinitis, a feeding tube is passed through the nose and down the esophagus. This is left *in situ* until the esophagus is healed, usually for a period of about ten days.

J. DANIEL WILLEMS, M.D.

Pearse, H. E., Jr.: Mediastinitis Following Cervical Suppuration. *Ann. Surg.*, 1938, 108: 588.

Mediastinitis may originate from many different sources and may range from a simple inflammatory process to a diffuse suppurative phlegmon which is often lethal. The author has for many years shown a particular interest in this condition, which finally led to anatomical and post-mortem dissection for the purpose of studying the path and spread of cervical infection. One hundred and ten cases of mediastinitis have been collected, 99 of which were obtained from the literature and 11 from the author's own experience.

In 64 patients he found the causative factor to be perforation of the cervical esophagus. Of these, 33 were operated upon and 24 recovered. Of the 31 patients who were not operated upon, 4 recovered.

In 13 patients the causative factor was suppurative lymphadenitis. All were operated upon and 7 recovered. The remaining 6 died.

In 11 patients the causative factor was a retropharyngeal abscess. Of these, 9 were operated upon and 6 recovered. Of the 2 who were not operated upon, 1 recovered.

Peritonsillar abscess was present in 8 patients. Operation was performed on 4, with 2 recoveries. All 4 of those who were not operated upon died.

In 6 patients, mediastinitis followed tracheotomy. Of these, operation was performed on 2, 1 of whom recovered. The remaining 4 were not operated upon and 1 recovered.

Spondylitis of the cervical spine occurred in 3 patients, 2 of whom were operated upon; both patients recovered. The one who was not operated upon died.

There were 3 cases of postoperative thyroidectomy followed by suppurative mediastinitis. Operation was performed on all 3 patients, only 1 of whom recovered.

The causative factor in 2 cases was Ludwig's angina. Both patients were operated upon and 1 recovered.

The retrovisceral space conveys infection from perforation of the esophagus, retropharyngeal abscess, and spondylitis of the cervical spine. The carotid sheath conducts the infection in most instances of suppurative lymphadenitis, peritonsillar abscess, and Ludwig's angina. The pretracheal space is the course followed by infection following tracheotomy or thyroidectomy.

The mediastinitis which follows cervical suppuration results from a dependent spread of infection along the fascial planes. If this gravitation of pus could be blocked, the chest infection would be prevented. Theoretically, this could be done by a prophylactic operation by packing the spaces in the neck. Such a procedure is indicated in cases in which the progress of the infection is very rapid. Even if it is too late to interrupt the gravitation, drainage of the space can still be established with release of tension and prevention of extension to the chest. In the absence of a rapidly spreading infection there is much less indication for such prophylactic blocking of the fascial spaces.

The management of mediastinitis involves a surgical attack and drainage of the infection, just as in-

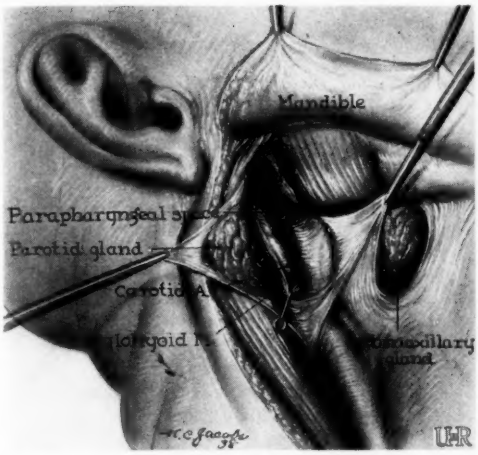

Fig. 1. The parapharyngeal space seen from the outside. The fused fascia is left in front to separate it from the submaxillary space. The parotid gland is turned back in this dissection for exposure. This could not be done so widely at operation without facial nerve injury. The parapharyngeal space extends up behind the angle of the jaw and ends below around the carotid artery. (Courtesy of J. B. Lippincott Co.)

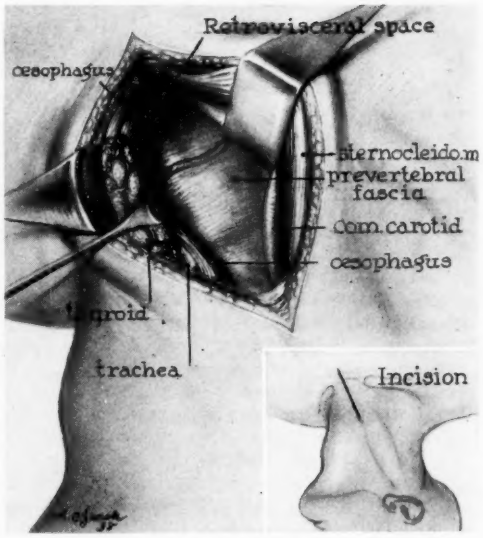

Fig. 2. Looking down into the posterior mediastinum through the retrovisceral space, as it is seen at operation. Orientation is easier if the drawing is turned so the head is up. The thyroid gland, trachea, and esophagus have been retracted mesially, while the carotid artery, jugular vein, and sternocleidomastoid muscle are displaced laterally. This exposure permits visual inspection of the space.

fection in a more accessible location. In this series of 110 cases, the mortality in patients operated upon was 35 per cent, in contrast to the mortality of 85 per cent in those not operated upon. Drainage was accomplished through the esophagoscope in 13 cases, through the chest wall in 14, and through the neck in 41 cases.

The incision in the neck is usually made parallel to the lower medial border of the sternocleidomastoid muscle, though it may be placed transversely to follow the skin folds. The sternocleidomastoid muscle is retracted and the fascia which is lateral to the sternothyroid muscle is divided to expose the carotid sheath and thyroid gland. Lateral retraction of the vessels and medial displacement of the thyroid gland will expose the trachea and esophagus. A certain amount of pus will usually be encountered and drains should therefore be placed at the bottom of the cavity.

Some surgeons prefer the approach behind the sternocleidomastoid muscle, but danger of nerve injury is greater in this location.

Suppurative mediastinitis from descending cervical infection is not always a hopeless condition, but is amenable to cure if energetic measures are taken to treat it. Familiarity with the anatomical arrangement of the cervical fascia and the spaces that connect the neck and chest is required for execution of the surgical procedures that are necessary. Persistence in postoperative treatment is most essential.

The author also presents a minutely detailed description of anatomical dissection of the neck and its various structures and spaces in relation to each other. The article is accompanied by many excellent drawings and diagrams. J. Daniel Willems, M.D.

SURGERY IN THE DIABETIC PATIENT

Collective Review

WALTER H. NADLER, M.D., Chicago, Illinois

THE current literature pertaining to diabetes is very extensive because of investigations in the fields of endocrinology and metabolism, and the introduction of protamine-zinc insulin. The important contributions on the subject prior to 1936 and 1937 are included in a text by Falta (21) and in the admirable monograph of Joslin (36). Selective, critical reviews by Wilder (81, 82), published annually for several years, have ably considered various phases of the problem. Root and Marble (59) have summarized literature that appeared after the publication of the last edition of Joslin's book. The following review is concerned with articles published within the last two years, which may be of special interest to the surgeon.

GENERAL CONSIDERATIONS

The subject of diabetes deserves serious study by every physician because, as stated by Root and Marble (59), "There are so many diabetics and they live so long." Statistical evidence indicates that the number of persons with diabetes in the United States is growing; the mortality figures show an increase that is both absolute and relative. Joslin, Dublin, and Marks (38) report that although the average length of life of diabetics has definitely increased in recent decades, the death rates are still much in excess of those for the general population. The death rate at all ages in the latter part of the period from 1926 to 1929 was 75 per cent below that from 1897 to 1913. The greatest gains have been made in young diabetics and the most rapid decline in mortality occurred after insulin became available. The expectation of life has greatly increased. At the age of ten the increase between the pre-insulin years mentioned and the period from 1926 to 1929 is estimated at about thirty years. With advancing age the increase is progressively less.

Ponteva (54), reporting results of treatment in Finland, states that after the use of insulin mortality in the clinic fell from 19 per cent of 86 cases to 6.8 per cent of 645 cases treated between 1923 and 1936. Coma as a cause of death was reduced from 81 per cent to 27 per cent. The marked increase in the number of diabetics was greatest in elderly women. In September, 1936, it was determined that 51 per cent of the patients previously treated were still living. As the cause of death, diabetes came first (45.1 per cent), pulmonary tuberculosis second (18.8 per cent), and circulatory diseases third (15.3 per cent). The highest mortality occurred among the peasant class and the best clinical results were obtained in the group of educated patients.

From the Department of Medicine, Northwestern University Medical School.

PATHOGENESIS

The outstanding recent contribution is the report from England by Young (85) of the production of permanent diabetes in dogs by means of injections of substance of the anterior lobe of the pituitary gland. Permanent experimental diabetes without pancreatectomy had not hitherto been effected although its production was awaited as the outcome of Houssay's brilliant investigations. Young reports that of 25 dogs injected with extracts made from the fresh, frozen anterior lobe of the pituitary gland of the ox only 1 failed to develop glycosuria, ketonuria, and polyuria after repeated intraperitoneal injections.

The results reported by Young, together with other investigations concerning the rôle of the pituitary and other endocrine glands in carbohydrate metabolism, constitute evidence against unitarian theories of the origin of diabetes, as stated by Peters (51). This writer is among those who believe that diabetes can no longer be considered a disease entity and that among the cases labeled diabetes may be found a variety of diseases. As a result each patient should be viewed as an individual problem demanding thorough examination and analysis.

Bjering (6) has demonstrated the presence of small quantities of a blood-sugar-raising principle (the diabetogenous hormone?) in the urine of healthy subjects. In some diabetics it was possible to demonstrate an absolute increase of the hormone in the urine; in others no greater quantities could be detected than are present in normal individuals. In a single case it was possible to check the excretion of the hormone by treatment with insulin. Large quantities of the hormone were demonstrable in the urine of

pregnant women. While the experiments support the dualistic theory of the pathogenesis of diabetes, the material presented is admittedly insufficient to warrant a definite answer to the question whether there are two forms of diabetes mellitus, a pancreatogenous and a hypophyseal form.

Impairment of liver function may be responsible for various manifestations that are apt to be attributed to the diabetes, itself. Locascio (45), in a study of 20 patients, shows that the height of polypeptidemia observed is in direct relation to the functional efficiency of the liver.

ASSOCIATED PATHOLOGY

Kitchell (41) reports on 50 patients who presented both a positive blood Wassermann reaction and undoubted diabetes, as shown both by blood and urine studies. In 31 cases the anti-luetic treatment was so inadequate that no effect on the diabetes could be expected. In 15 cases adequately treated no effect on the diabetes was observed. In 4 cases, however, the diabetic symptoms disappeared. The recovery is believed to be more apparent than real since these patients were followed up only a short time.

As regards hypertension, Strauss (71) found a systolic pressure of 160 mm. of mercury or more in 28 per cent of 500 diabetics. In contrast, among 500 non-diabetic individuals of comparable age the incidence of hypertension was less than half as great. Most of the patients were over fifty years of age. In more than a third of the patients the diabetes had been present for a period of at least eight years.

Since gall stones and diabetes often coexist in women past the age of forty, Allen (2) believes that everyone who has cholelithiasis or who has had a gall-bladder operation should have periodic examinations of the urine. If a mere trace of sugar is found the blood sugar should be examined. If diabetics have abdominal symptoms gall-bladder disease should be suspected. Cholecystectomy often has a beneficial effect on the diabetes.

Boulin and Kaufmann (10) consider that no diabetic is safe from retinitis despite age, duration of the diabetes, or absence of hypertension, and recommend routine examination of the eyes. Once retinitis has set in they believe insulin should be used cautiously. Two cases, both of women, aged thirty-three and thirty-five years, respectively, in which the diabetes had been of short duration, are reported. Both patients were undernourished; hypertension and signs of vascular sclerosis or renal insufficiency were absent. Retinitis developed in spite of insulin treatment.

GLYCEMIA

That hyperglycemia without glycosuria is common is pointed out by Davidson (17) who reports that in 204 glucose-tolerance tests made because a study of endocrine imbalance was indicated, hyperglycemia without glycosuria was found in 30 cases, hyperglycemia with glycosuria in 22 cases, and glycosuria with normal blood sugar in 5 cases.

Hartmann (27) reports some 250 instances of hypoglycemia in infants and children. In only one instance was there reason to believe that there was real pancreatic pathology. At operation no tumor was found, but a subtotal pancreatectomy was followed by definite improvement. Considerable hypoglycemia is a normal state in newborn infants for the first few days, following which complete adjustment occurs. Some children have symptoms of hypoglycemia periodically, especially after missing a meal or when they have infections that cause anorexia or vomiting. They become nervous, and are apt to have a convulsion or become unconscious. Some of these children are naturally very sensitive to insulin; in the cases of 2 boys the fathers were found to be similarly sensitive.

Rathery and Froment (58) believe that urine tests and not blood-sugar studies should be used as a guide in the treatment of most cases, since hyperglycemia is not a measure of the extent of damage to the glucose metabolism. They consider estimation of the blood sugar to be variable and unreliable; it is often useless, if not dangerous, to try to bring the blood sugar to normal. The urinary sugar output represents far better the adaptation of the organism to its faulty metabolism. The study of glycemia is admitted to be necessary at times, such as at the onset of treatment, when the use of insulin is started, in cases of coma and of insulin intolerance or resistance, and in the event of operations. Most writers share the opinion that urine tests furnish the best guide to treatment. As stated by Peters (51), the blood sugar may usually be assumed to fall to, or below, normal limits at intervals during the twenty-four hours if the urine is sugar-free. During the period of adjustment examination of four specimens of urine, before meals and at bedtime, gives valuable information. Blood-sugar estimations are of special value in the detection of hypoglycemia and solving of the problems concerned with the regulation of diet and insulin dosage. Blood-sugar determinations in the fasting state may not be necessary; blood may be collected at a time most advantageous for the individual case. Bugnard, Colombies, and Costes

(14) determined the blood sugar immediately before operation, directly afterward, and subsequently at two-hour intervals, and found that elevation is due to the anesthetic used (general, local, or spinal), to emotional factors, and to the gravity of the operation. They conclude that blood-sugar curves have a practical application in the prognosis and the prevention of the general intravenous introduction of glucose, adrenalin, or pituitrin which are often given in apparent cases of cardiovascular failure when, actually, the basis of the syndrome is hyperglycemia. Being antagonistic to insulin, adrenalin and pituitrin are really contraindicated.

PREVENTION

The prevention of obesity and diabetes, and the relationship of these two conditions have been discussed by Goodrich (23) who stresses the value of competent, periodic health examinations. Glassberg (22) has emphasized the importance of weight reduction and subsequent maintenance of a normal weight in obese diabetics. Five cases are reported in which a diagnosis of "cured" diabetes seemed possible. The original glucose-tolerance curves of diabetic type became normal after substantial reductions in weight. After the tolerance tests became normal the only dietary rule necessary was avoidance of any gain in weight.

MEDICAL TREATMENT

In the light of investigations that indicate a varied mechanism in the production of the diabetic syndrome, evaluation of each case and individualized treatment are essential, as stated by Peters. Of importance to the true diabetic who requires insulin and constant adherence to a special diet is the inculcation of the philosophy of the diabetic life (30). In the achievement of this philosophy the character, mental caliber, and psychic behavior of the patient are of major importance, his environment and his physician of lesser influence, and the character of the disease possibly of least importance.

Graham (24) has surveyed the changes in the treatment of diabetes during the last fifteen years. He is convinced of the value of the new insulin for the great majority of cases. Early reports concerning its use, summarized by Wilder (81) and published in February, 1937, were almost unanimously favorable. While one cannot be dogmatic in regard to the treatment of diabetes this is undoubtedly the era of protamine-insulin treatment (78).

Practical clinical conclusions concerning protamine-insulin were published by Joslin (37) in July, 1937. Previously untreated patients rarely have difficulty with protamine-zinc insulin. Because the effect may last for twenty-four hours or longer an additional feeding at bedtime and often in the middle of the morning and afternoon is necessary. Reactions are to be avoided. They are usually manifested by fatigue, nausea, headache, and other typical symptoms of hypoglycemia, and are generally more gradual in onset and milder than with regular insulin. In order to avoid reactions, which are especially dangerous in elderly individuals, it has been necessary to sacrifice the ideal, hitherto aimed at in theory but by no means always attained in practice, of keeping the urine constantly sugar-free. Joslin is satisfied if severe cases are controlled 90 per cent instead of 100 per cent, that is, if the excretion of sugar is not over 10 per cent of the actual carbohydrate in the diet. A patient receiving 150 gm. of carbohydrate is, accordingly, considered well controlled if only 10 per cent, or 15 gm. of glucose, appears in the urine in twenty-four hours. Local reactions are common at the start of treatment but usually disappear after a few weeks. Supplemental regular insulin must occasionally be used before breakfast; most juvenile diabetics need regular insulin. In careless or erratic diabetics the use of protamine insulin presents difficulties, as stated by Root and Marble (59). For patients previously treated with regular insulin the transfer to the slowly acting preparation may be confusing; patients whose meals are irregular in time and quantity may be poorly controlled or have reactions. If management on regular insulin has been satisfactory there is often little to be gained by transfer. The new preparation has proved of value during operations.

In describing the advantages of protamine-zinc insulin in surgery Joslin and his coworkers (39) report that during 1937 operations were performed upon 187 diabetics, all of whom received the new insulin during and after surgery. The operations included 52 amputations, 31 laparotomies, 18 tonsillectomies, 13 thyroidectomies, 6 nephrectomies, and 66 miscellaneous procedures. The constant, slow action of protamine-zinc insulin given in the morning before operation makes the possibility of a reaction during anesthesia unlikely, protects the liver function, and makes possible the utilization of large amounts of carbohydrates both before and after operation. The danger of serious hypoglycemia after operation, particularly when glucose has been given intravenously, is decreased by the use of the new insulin; occasional serious reactions had occurred when regular insulin was used together with glucose solution.

Harris and Harris (26) state that in less than two years it is safe to say that protamine insulin has replaced regular insulin in the vast majority of cases treated by physicians experienced in the treatment of diabetes. In many cases, however, one or more doses of regular insulin are also required. Experience with about 100 cases has demonstrated many advantages over regular insulin. A high carbohydrate diet (often about 300 gm.) and accessory feedings three hours after meals are favored by these authors. Dunlop and Pybus (19) consider that in Scotland the average diabetic needs for maintenance from 115 to 130 gm. of carbohydrate daily; in selected cases from 200 to 250 gm. are sometimes used.

Warvel and Shafer (77) report on 217 patients receiving protamine insulin and find three groups: (1) those needing both regular and protamine-zinc insulin in the morning and regular insulin later in the day; (2) those requiring both kinds of insulin in the morning; and (3) those controlled by protamine-zinc insulin alone. Over one-half of their patients belonged in the third group. McCullagh (47) remarks that normal fasting blood sugar marks the limit of increase in protamine-zinc-insulin dosage. Since the maximum effect is usually maintained for from twelve to eighteen hours and the whole effect may last over fifty hours, it is seldom necessary to use more than one dose daily. Sixty cases have been treated; the average diet was Ch 182, P 66, F 75. Meyler and deMaar (48) report good results in 40 previously untreated cases. The protamine-insulin effect lasted at least twenty-four hours. In most cases one injection daily sufficed; a few patients needed an additional injection of regular insulin. Lavietes (43) states that any prescribed insulin dose can only be a first approximation. With protamine insulin, considered a valuable adjunct to treatment, the maximum tendency to hypoglycemia is during the night or before breakfast. Schwab (66) in France reports favorable results with protamine-zinc insulin and Boulin (9), after comparing the various preparations available, found that protamine-zinc insulin was the most satisfactory. The superiority of protamine insulin over regular insulin after pancreatectomy in dogs and the ability of the former type to control severe clinical diabetes characterized by nocturnal hyperglycemia are reported by Nadler and Isaacs (49). Control of a case previously impossible of satisfactory management with regular insulin has been reported by Gratton (25-a). Introna (32), in Italy, has verified the gradual lowering of the blood sugar and the more prolonged effect of protamine insulin. Borromeo (7), in Italy, has reported on 12 cases successfully controlled by protamine-zinc insulin. If the blood sugar remains relatively level on an appropriate diet and glycosuria occurs chiefly after meals, morning administration of the insulin is suggested after cutting down the carbohydrate of the first meal. If, however, the blood sugar level is lowest in the morning it is recommended that the insulin be given at night. Neuhoff (50) encountered cases that seemed better controlled by regular insulin, but predicted that such instances would become less frequent as more experience with the new product was gained. Edmondson (20) views protamine insulin as a veritable blessing, especially in difficult cases, but warns that if the use of regular insulin is not understood the new preparation should not be used. Zubiran (86), in Mexico, admits that better control is possible with protamine insulin but believes it cannot be used in all cases; he considers it still in the experimental stage.

Ralli, Fein, and Lovelock (57) have reported that it was impossible to change to protamine insulin successfully in 4 of 20 patients with severe diabetes previously treated from two to seventy-two months with regular insulin; 5 returned to regular insulin because of alternating uncontrolled glycosuria and insulin shock; 8 needed soluble insulin in addition to protamine-zinc insulin. In only 3 was the diabetes controlled by protamine-zinc insulin alone. All of these patients originally received 3 or 4 injections of regular insulin daily; the carbohydrate allowance was from 200 to 250 gm. Jordan (35), reporting results in 60 cases before and after the use of protamine insulin, estimated that benefit resulted in roughly 80 per cent of the cases, but he considered that adherence to treatment is more important than the kind of insulin used.

In diabetic children accustomed to regular insulin a shift to the new preparation produced, on the whole, very disappointing results in the hands of Jackson and Boyd (33). Of 200 children previously treated with insulin with a standard of control which included freedom from any degree of glycosuria throughout the twenty-four hours and avoidance of hypoglycemia, 13 were shifted to protamine-zinc insulin. It was found impossible to maintain the former standard of control. The superiority of the new insulin over the old was not established. The use of protamine-zinc insulin was contraindicated unless one had full knowledge of its dangers. It was concluded that the diabetic child who was a candidate for protamine-zinc insulin was the exception rather than the rule. White (78), on the other hand, reported very good

results when the rigid standard of maintaining the urine constantly sugar-free was relaxed somewhat. The end-results of treatment as of October, 1937, in 604 patients with the onset of diabetes in childhood and who had been adjusted to protamine insulin in the previous two years were reported. As measured by mortality rates and continuance of its use, protamine-zinc insulin was successful. Five hundred and seventy-four patients (95 per cent) were known to be taking protamine-zinc insulin alone or in combination with regular insulin; only 17 (2.8 per cent) had discontinued the new insulin in favor of the old; 4 (0.7 per cent) had died; and 17 could not be traced. Control of the diabetic state after use of the new insulin often lasted three times as many hours as after ordinary insulin. The W-shaped blood-sugar curve and nocturnal hypoglycemia, characteristic of juvenile diabetes, can be abolished. Acceleration of growth in stature has occurred. Severe reactions are inevitable if the maintenance of constant aglycosuria is attempted. For this reason a standard of control of 90 per cent instead of 100 per cent, based upon the twenty-four-hour urine-sugar output, has been adopted. The occurrence of postprandial glycosuria and hyperglycemia is less dangerous than nocturnal hyperglycemia as measured by the incidence of acidosis and hepatomegaly. Bettica (5), in Italy, in a discussion of diabetes in children, adds nothing new and paints a gloomy picture with which we in this country are not familiar in the statement that these patients are inadequate, physically and mentally, need constant attention, and are destined to succumb at the beginning of adolescence.

Jenkinson and Milne (34) report a clinical trial of insulin-tannic-acid-zinc suspension in 9 stabilized diabetic patients and compare the blood-sugar levels with those produced by protamine-zinc insulin and ordinary insulin. A delayed but prolonged hypoglycemic effect was observed, but there was a tendency in some patients toward the production of irritant skin lesions.

Baudouin, Lewin, and Azérad (4) studied the "hypoglycemic limiting dose" of insulin, that is, the smallest amount that, injected slowly and continuously into the peripheral vein, will abolish hyperglycemia in dogs and in human subjects. In the normal subject the required dose was found to be between 0.01 and 0.02 units per kilo per hour. This was from three to five times weaker than for an anesthetized dog. The normal secretion of insulin under basal conditions is around 0.005 units per kilo per hour. For a man weighing 60 kgm. the total pancreatic secretion would be 0.3 units in one hour; this represents 0.006 mgm. of pure insulin. In a group of diabetics from 0.2 to 0.3 units per kilo per hour was necessary to bring the blood sugar to normal in three hours. To maintain normal levels 2 patients required 0.01 unit and 0.1 unit, respectively. The effects of slow and continued insulin administrations were, in all cases, an immediate action on the glycemia and glycosuria, but acetonuria was not affected until glucose was given intravenously with the insulin, when it cleared up very quickly. This method of simultaneous intravenous insulin and glucose injection has given excellent results in a number of cases of severe diabetes and when complications, such as infection, coma, and surgical intervention, were present.

Schur and Pappenheim (65), investigating the question of insulin effect, have reported additional studies based on the relation of phosphate excretion to the administration of insulin, glucose, and phosphates. The fact that orally administered phosphates are retained after the use of insulin supports the view that insulin acts as an assimilation hormone on fat and carbohydrate. Hypoglycemic manifestations after insulin are not to be interpreted as a direct result of glucose deficiency of the tissues, but as due to substantial changes in the organs concerned. The recurrence of hypoglycemia hours after the effective use of glucose for the original attack indicates that active insulin remains in the organism. Large doses of insulin can produce damage even when neutralized by large amounts of glucose.

In normal, unanesthetized rabbits Bridge (13) found that insulin did not affect the total amount of glycogen deposited in the liver and muscles as a result of a constant six-hour infusion of glucose. The predominant effect observed was a shift in glycogen deposition from liver to muscle tissue. An appreciation of this action offers a more satisfactory explanation of the mechanism involved in hypoglycemia reactions.

Allen (1) concludes that no animal ever succumbs to insulin hypoglycemia while eating up to the capacity of a normal, hungry animal of the species; anorexia always precedes any dangerous symptoms. Strong or average persons have a high tolerance for insulin, in accordance with the prevailing view that insulin is non-toxic for them up to an extremely high limit. This, however, does not imply that similar doses can be safely given to weak or sensitive individuals. Very small amounts of carbohydrate suffice for combating the effect of insulin, but the carbohydrate needed must be given over a considerable period. Insulin intoxication, characterized by depression, malaise, weakness, anorexia, vomiting, and circulatory

failure, can be recognized in animals before the occurrence of hypoglycemia. It is not due to hypoglycemia nor prevented or cured by glucose. It depends upon the production of pathological hyperinsulinism and is widely independent of the absolute insulin dosage. The insulin dosage that can be tolerated by a strong man without such intoxication is estimated at above 15 units per kgm. of weight.

Himwich and Fazekas (29) report that in non-diabetic patients with infection, resistance is developed against protamine insulin. The effect of the disease in stimulating the endocrine glands and the nervous system results in a rise in the blood sugar, which counteracts the effects of endogenous or injected insulin. Consequently it is suggested that ordinary insulin is preferable to slow-acting protamine insulin in cases of infection. Infection, not fever, is the potent factor since after the injection of insulin, diathermy fever produces little if any change in the blood sugar.

Sakharoff and Rossiisky (60) report from Russia the use of pancreotoxin in 50 cases of diabetes, with a definite therapeutic effect. The serum of an animal, immunized with human pancreas obtained from corpses of persons who had died a sudden death, was injected subcutaneously in amounts of from 0.1 to 0.2 c.cm. daily for from fifteen to forty days. Stimulation of the pancreatic activity was believed to occur. Patients were reported to show general improvement, a decrease or even disappearance of the classical symptoms, glycosuria and hyperglycemia, and a higher carbohydrate tolerance.

Pijoan and Zollinger (53), in treating the menopausal syndrome with from 1,200 to 1,600 roentgens of irradiation to the pituitary gland, observed no changes in the carbohydrate metabolism. Since massive irradiation of the pituitary body cannot be directed entirely to the gland itself, but must act as well on neighboring nervous centers, it would be extremely difficult to evaluate any changes that might occur. The employment of roentgen rays in the treatment of diabetes would, therefore, appear to be attended with considerable uncertainty.

DIABETES AND TRAUMA

Injuries are common because of sequelæ and because so many patients are old. The literature on the subject has been reviewed and evaluated by Joslin, Root, and Marble in a chapter of Brahdy and Kahn's book, "Trauma and Disease" (11). They conclude that trauma is practically never the primary cause of diabetes. In order to justify any relationship, the time elapsing between an accident and the onset of diabetes must be very short. Special effort should be made to determine the previous presence or absence of diabetes because the disease is so common and is often latent, mild, or overlooked unless sought. Diabetes in the family and obesity in middle age suggest a predisposition. Glycosuria without hyperglycemia, including renal glycosuria, and harmless levulosuria and pentosuria, must be differentiated. Identification of blood and urine specimens should be assured and reliable methods and technique of examination demanded. Organic injury to the nervous system has not been proved to cause permanent diabetes in experimental animals or, in the opinion of the authors, in clinical cases. Temporary glycosuria, however, often results. Psychic trauma may also produce temporary glycosuria, but it never causes diabetes. It is seldom known to aggravate an existing diabetes.

Ducastaing and Hautefort (18) report a case of complete rupture of the popliteal vein and artery by indirect trauma in a diabetic sixty-five years of age. Susceptibility of the vascular walls to injury is increased by changes due to diabetes. Other cases of similar rupture are cited and surgical measures are discussed.

DIABETES AND PREGNANCY

Lactosuria may be present in the later months of pregnancy and may be confused with diabetes. It is usually ascribed to a lowering of the renal threshold, but, as pointed out by Hurwitz and Irving (31), there may also be associated some impairment of the carbohydrate metabolism. The glucose-tolerance test is usually within normal limits. The presence of lactosuria may be verified by a fermentation test.

Pregnancy may precipitate clinical diabetes in a potential diabetic. Infection, such as syphilis, may further impair liver function or, in some other manner, contribute to the onset of glycosuria, which later may prove to have been an early manifestation of diabetes. Vignes (74) reports the case of a young woman with no glycosuria before pregnancy. Glycosuria appeared in the first pregnancy, which produced a dead fetus. In the second pregnancy glycosuria recurred; coma intervened and was relieved by insulin; at seven months a macerated fetus was delivered. No information is given concerning Wassermann tests, but anti-syphilitic treatment was continued during the entire third pregnancy, which produced an apparently healthy child delivered by cesarean section. Subsequently both mother and child had diabetes.

Management of the diabetes requires the most efficient medical care. Obstetricians should not handle these cases alone. Treatment must be individualized and a frequent check made of the patient's condition. Under proper management the mother may expect to go safely through pregnancy and labor. The outlook for the fetus, however, is much poorer than in non-diabetics. Most writers believe that the nearest approach to normal delivery is desirable, but some advise cesarean section for the average case.

White (79), in an analysis of 271 pregnancies in 191 diabetic patients of Joslin, found a surprising improvement in the results following the use of insulin as compared with the outcome in the pre-insulin era. The incidence of spontaneous abortion has been reduced by more accurate control of the diabetes. Giant fetuses are common. Numerous pregnancies are discouraged because of the morbidity hazard and, more important, because of the potentiality of inheritance of the disease. Hurwitz and Irving (31) report that among 51 diabetics delivered at the Boston Lying-in Hospital since 1916, the only fatality occurred in a woman who had severe eclampsia. A sudden decrease in tolerance is common in the middle trimester and requires additional insulin. Between 1916 and 1932 34 diabetic pregnancies produced 35 infants with a gross fetal mortality of 42.8 per cent. Since 1932 there was a gross fetal mortality of only 16.7 per cent in 18 diabetic pregnancies. The excessive size of the fetus and the increased frequency of fetal anomalies were less important factors than neglect of the diabetes. Cesarean section should be reserved for patients whose infants exceed the normal weight or for patients that present some other clear obstetrical indication. Titus (72) has reported 43 cases. Of the 16 patients treated in the last two years not a mother was lost, but 9 babies died in pregnancies of seven or more months' duration. Individualization of the method of delivery is urged, but when the baby seems quite big enough cesarean section is suggested as the safest method of avoiding intra-uterine death. Herrick and Tillman (28), in reporting on 56 patients with diabetes, comment on the high incidence of vascular disease and hyperthyroidism and on the liability to toxemia. The fetus may be either underweight or overweight. Routine cesarean section is considered unwise. Brandstrup and Okkels (12) report 22 instances of pregnancy in 19 diabetics observed in the Rigshospital of Copenhagen. Precomatose conditions or coma appeared in 6 patients, and hypoglycemia was observed in 13 patients, usually in connection with hyperemesis and a lowered state of nutrition. The insulin requirement decreased in 6, increased in 4, and remained unchanged in 8 patients; no insulin was given to 4 patients. No clinical evidence was found of any permanent change in the severity of the maternal diabetes as the result of the pregnancy. The obstetrical risk is somewhat increased by a tendency toward hydramnios, excessive size of the child, and, especially, infection when eczema of the vulva is present. Only 10 of 23 children were discharged from the hospital living. Six were stillborn with third-degree maceration; 2 were excessively large and died during delivery; 5 died in the first days after birth. Two of the last group were premature. In no case was hypoglycemia proved as a cause of death. The high infant mortality may probably be attributed to maternal hyperglycemia and acidosis. In 3 instances changes observed at necropsy in the pancreas, hypophysis, and thyroid are described. It is hoped that the use of new insulin, which makes possible the avoidance of great variations in the blood-sugar concentration, will improve the prognosis for the diabetic mother and, especially, for her child.

SURGICAL TREATMENT OF DIABETES

Surgical procedures proposed for treatment and reported in experiments on animals and in man have been reviewed and evaluated by Violet (75). He considers diabetes a disease of the regulatory mechanism of the carbohydrate metabolism and differentiates essential diabetes from symptomatic diabetes due to lesions of the pancreas, the suprarenal, thyroid, or parathyroid glands, the hypophysis, or the third ventricle. In essential diabetes lesions of the pancreas are rare and the insulin content is normal. Attention is called to the fact that a depancreatized dog is not comparable to a human diabetic; this explains the conflicting results between animal and human experimentation. The possibility of surgical treatment in diabetes is based on a physiological classification of the endocrine glands as being hyperglycemic or hypoglycemic, and on our knowledge of the nervous regulation of the carbohydrate metabolism. In the attempt to cause an increased secretion of insulin, efforts have been made to activate the pancreas and the salivary glands, to perform a sympathectomy of the pancreatic arteries, and to make pancreatic grafts. As far as their clinical application is concerned these attempts have met with almost complete failure. In the effort to depress hyperglycemic factors, attack has centered on the suprarenal and thyroid glands. Only in the case

of splanchnic section have promising results been obtained and reports are conflicting. Violet ascribes the benefit observed to the suppression of occasional, sudden discharges of adrenalin. He calls attention to the fact that the operation has not been performed many times and that it is not without danger, but believes that it may prove of value in selected, severe cases with arterial complications. If diabetic symptoms are secondary, as sometimes seems to be the case in patients with gall stones, pancreatic stone, or hyperthyroidism, beneficial results may be expected from surgery aimed at the primary cause. Chabanier, Bréhant, and Donoso (15) report 3 cases of unilateral splanchnicotomy in severe diabetes. A detailed report is presented of 1 patient fifty-eight years of age with diabetes of ten years' duration. The diabetes became progressively more severe. On a diet of Ch 90, P 75, F 140, insulin dosage of 360 units (120–120–120) resulted in from 45 to 60 gm. of sugar in the twenty-four-hour-urine specimens. Finally, after resection of the left splanchnic nerves, glycosuria and acetonuria disappeared; a year later a daily insulin dosage of 160 units was required. The improvement was ascribed to the operation.

Sendrail, Cahuzac and Garipuy (67), using normal dogs, attempted to clarify the effects of sympathectomy of the pancreatic arteries on glycogen regulation. Results were controlled by study of the glycemia, of the glycogen regulation, and of the structural changes in the pancreas. The operation causes an initial period of hyperemia of the pancreas with hypoglycemia by means of vasodilation; a second period of hyperglycemia lasting until the twentieth day, apparently due to mechanical irritation; and a third phase of prolonged hypoglycemia associated with the establishment of circulatory equilibrium. Anatomical studies revealed temporary postoperative anemia, a gradually progressive and diffuse hyperemia in the first twenty days, congestion (especially of the islets) about the end of the first month, and then a gradual return to the normal appearance. The results suggest that a persistent increase of the insulin supply is produced. Possible explanations are that capillary dilatation may make secretory function of the pancreas more rapid or efficient, or that the sympathetic nervous system may regulate the gland activity and the sympathectomy directly stimulate insulin formation.

Piaggio-Blanco and Sayagués (52), after reviewing pertinent literature on the influence of the thyroid on carbohydrate metabolism and on the effect of ablation in pancreatic diabetes, and carefully analyzing studies on one of their patients, conclude that removal of a normal thyroid gland has no appreciable influence on the course of human diabetes. The transitory postoperative hypoglycemia reported during brief studies may have been caused by surgical trauma, postoperative fasting, or parathyroid insufficiency.

Mastrosimone (46) has reported the results of artificially produced parotid swelling on experimental pancreatic diabetes. Fifteen dogs were used. Injections of 2 c.cm. of alcohol-iodine solution containing from 10 to 15 drops of benzene were made through the ducts and directly into the exposed parotid glands, after which the ducts were closed for twenty-four hours by a silk ligature. Swelling usually appeared within from six to forty-eight hours and lasted for from twenty to sixty days. No atrophy resulted; the chief residual change was hypertrophy of the glandular connective tissue. Pancreatectomy was done, in some instances before and in others from three to ten days after the onset of parotid tumefaction. In all of the animals an influence of the parotid glands on the diabetes was demonstrated. The lowest amounts of blood sugar were found when the pancreas was removed after the onset of parotid swelling; some dogs lived for more than four months on ordinary diets. The greatest amounts of blood sugar were found when Stenson's ducts were merely ligated and no injections were made into the glands.

SURGERY IN THE PRESENCE OF DIABETES

Although some writers, as Gratton (25-b), simply state that the risk of operation is slight under present-day management with insulin, most authors stress the fact that the presence of diabetes constitutes a definite, added danger. It is generally agreed that treatment of the diabetes should be individualized under medical supervision, that pre-operative and postoperative care are of vital importance, and that unless an emergency exists two or three weeks spent in preparation for surgery is advisable.

Priestly (56) points out that, properly managed, the surgical diabetic never dies from coma, but frequently from infection. If the surgical condition is not a complication of the diabetes the risk of operation appears only slightly greater than in the non-diabetic. In 17 cases of major surgery in diabetics there were 3 deaths, whereas in 13 surgical procedures for diabetic conditions there were 5.

Lindsay and his coworkers (44) consider that the chances of a successful outcome are directly proportional to the amount of pre-operative and postoperative medical care given. They report a

reduction in mortality from 25 per cent (in 28 operations from 1924 to 1929) to 10.5 per cent (in 57 operations from 1930 to 1936) as a result of better medical management.

Standard, Brandaleone, and Ralli (69) report a mortality rate of only 6.9 per cent in 172 patients who had received excellent care and observation in various special clinics, as compared with 20.8 per cent in a poorly controlled group of 302 patients. In cases of major amputation a mortality rate of 16 per cent in adequately treated cases presented a striking contrast to a mortality rate of 49 per cent in a poorly managed group.

Wills and Gray (84) insist that the surgical diabetic is primarily a medical problem; close co-operation between a "diabetic-minded" surgeon and an internist is necessary. A thorough understanding of acidosis and peripheral circulatory collapse is essential. The choice of anesthetic should be individualized. Under such favorable conditions diabetes in the surgical patient should not greatly influence the operative risk.

Stoerring (70) also stresses the need of the closest co-operation between the surgeon and internist. In addition to the objectives of avoidance of acidosis and increase of the sugar tolerance he favors the principle of "over-insulinization." Schoenbauer and Dibold (64) point out the possible danger of insulin shock to diseased blood vessels and emphasize the fact that in gangrene of the extremities the decisive factor is the degree of severity of vascular change and not the severity of the diabetes. Landesman (42) compares the preparation of the non-emergency diabetic case with that of the emergency surgical diabetic. In the former, observation for at least two or three weeks is desirable and treatment should be individualized.

Smith (68) calls attention to the fact that the usual statement that a controlled diabetic can be operated upon the same as a non-diabetic individual is not wholly true. "Controlled diabetics are postoperatively more prone to wound infections in clean contaminated cases. Pneumonia is more prevalent following upper abdominal operations. Trivial wound infections are more apt to go on to the more serious ones with fascial sloughs, disruptions with and without evisceration, and hernia formation, necessitating subsequent operative repair. They do not stand multiple anesthetics or operations as well as non-diabetics. Diabetes is a desperately severe complication in any case of carcinoma. The mortality of cancer surgery in uncontrolled or uncontrollable diabetics is so prohibitive that only palliative procedures should be undertaken upon them." Since premature and relatively severe arteriosclerosis may be expected in most chronic diabetics of middle age, accurate evaluation of the cardiovascular and renal status is necessary prior to any elective operation and is advisable before any surgical procedure.

Charbonnier and Schauenberg (16) report the case of a sixty-one-year-old woman with diabetes and carcinoma of the rectum. After sixteen days of preparation a laparotomy was performed and the wall of the small intestine was accidentally cut. The cut was sutured and no complication was anticipated. However, a fecal fistula formed. The second operation was performed three weeks later. Both the abdominal and the anal incision gradually opened without signs of suppuration after six weeks. Death occurred two months after the first operation. The authors are convinced that, from the surgical viewpoint, a diabetic cannot be considered a normal subject and that it is particularly unwise to operate upon a patient with cancer. No mention is made as to whether a prolonged period of dietary deficiency had preceded hospitalization, and no information was obtained regarding the Vitamin-C content of the blood, a deficiency of which may have been a factor in the failure of the incisions to heal.

Of special importance in diagnosis and treatment is the fact that diabetic acidosis may simulate a surgical abdomen producing nausea, vomiting, localized rigidity, fever, leucocytosis, and occasionally pyuria and hematuria. This phenomenon, described by Wills and Gray (84), is ascribed by them to a deficiency of sodium-chloride. Stoerring (70) believes that toxic irritation of the celiac plexus is responsible. The fact that acute appendicitis in a diabetic may present unusually mild symptoms adds to the difficulty of diagnosis. Bothe and Beardwood (8) report that 74 per cent of 136 patients with diabetic acidosis presented abdominal symptoms such as pain, nausea, and vomiting, and usually fever and leucocytosis. Before operation upon any diabetic because of abdominal symptoms acidosis should be ruled out. When abdominal disease is actually present the symptoms are apt to be less severe than the pathological changes would lead one to expect.

Preparation for surgery in elective cases demands (1) an adequate supply of proteins, vitamins, and minerals, depletion of which may have occurred in long-standing, uncontrolled diabetes, especially in patients of poor economic status; (2) control of the diabetic state by means of insulin and appropriate diet (in previously untreated cases the new insulin appears to offer

many advantages); and (3) measures immediately preceding operation that will insure optimal glycogen reserve in the liver and protection against dehydration and acidosis. The absence of ketosis prior to operation is clearly desirable and almost always possible to attain. It is advantageous but not essential that the urine be free from sugar, especially in elderly, arteriosclerotic individuals in whom hypoglycemia is more dangerous than slight glycosuria. That blood-sugar levels be normal prior to operation is theoretically desirable, but often difficult or even impossible of attainment, and is relatively unimportant if the twenty-four-hour excretion of glucose in the urine is small. Ketosis and hyperglycemia may be symptoms of inflammation and suppuration as well as of the severity of the diabetes. It is held by many writers, and clinically appears to be true, that normal glycemia favors healing without infection.

The diet before operation should be individualized. The exact type, as regards carbohydrate content, is unimportant provided its composition is known and utilization is insured by adequate amounts of insulin. Standard (69) mentions using Ch from 180 to 250, P from 70 to 80, and F from 75 to 85 gm. with sufficient insulin before meals to keep the urine sugar-free; Smith (68) gave a balanced diet of Ch 100, P 50, F 60, and Landesman (42) usually prescribed Ch 100, P ½ gm. per kgm. of body weight, and F 60, as a routine preliminary diet. Standard gave the average patient an infusion of 1,000 c.cm. of physiological salt solution with 50 gm. of dextrose two hours before operation and again after operation. For minor procedures 300 c.cm. of orange juice were given by mouth an hour and a half before operation. Stoerring (70) employed a more elaborate regimen of glucose and insulin administration, especially in major abdominal operations, in the belief that systematic "over-insulinization" favors wound healing. In acute surgical conditions Stoerring gives from 20 to 40 units of insulin shortly before operation and from 80 to 100 c.cm. of 25 per cent glucose 15 minutes later. Following operation glucose is usually given subcutaneously or intravenously, and small, liquid feedings are begun as soon as possible.

Peripheral circulatory collapse, contributed to by dehydration, hyperventilation, and cooling, is to be guarded against. As stated by Wills and Gray (84), the blood pressure is an excellent and simple clinical guide to the presence or absence of medical shock and should be recorded at frequent intervals in all cases. "Dehydration should be combatted by large volumes of fluids, preferably saline, which can be given intravenously to restore the depleted mineral base; whole blood or acacia solutions may be preferable in emergencies. Hyperventilation will disappear as the alkaline reserve is raised, and cooling can be combatted by the external application of heat." When food is tolerated by mouth, feedings containing from 20 to 50 gm. of carbohydrate may be given at intervals of four hours. Insulin is adjusted after operation on the basis of urine tests, being given before each feeding in amounts varying with the sugar content of the urine. Usually, in from four to six days the original diet, divided into four or five feedings, may be allowed in semi-solid form. In from eight to ten days the original diet may ordinarily be resumed.

The choice of anesthetic should be individualized. Among general anesthetics, nitrous oxide and ethylene are usually preferred; cyclopropane has been favored, and ether disapproved except for narcosis of short duration. Wills and Gray (84) state that procaine preparations, whether used intraspinally or for local infiltration, apparently have no deleterious effect on the carbohydrate metabolism. Nitrous oxide and ethylene produce only slight changes if the anesthesia is not prolonged. Nitrous oxide with ether produces more marked changes, but may be used if steps are taken to counteract the ensuing acidosis. Nitrous oxide and oxygen are unsatisfactory for most abdominal operations because they give poor relaxation. For operations on the lower extremities, perineum, and lower abdomen Wills prefers spinal anesthesia. Schoenbauer (64) recommends ether inhalation for operations of short duration, or evipan narcosis. From a study of 40 consecutive, non-diabetic cases in which the blood sugar was closely followed through the period of ether anesthesia and for some time afterward, Pratt (55) concludes that in non-diabetic patients, whatever the characteristic effect of ether on the blood-sugar level, it is subject to numerous, individual variations; a primary glucose mobilization, apparently due to adrenalin, may or may not be followed, according to the depth of anesthesia, by a secondary and probably more profound interference with the normal course of sugar utilization; that this effect is produced by anesthetics other than ether; and that the rise of the blood sugar seems to be a welcome physiological compensatory phenomenon.

THE TREATMENT OF SURGICAL COMPLICATIONS OF DIABETES

Of the complications of diabetes, localized infections, especially carbuncle, which is the most

dangerous surgical complication, and gangrene of the extremities, which is the most frequent serious surgical accident, have received the greatest attention.

In a series of 45 carbuncles, Standard, Brandaleone, and Ralli (69) reported no deaths among 9 patients who were under careful medical management, and 7 deaths among 36 patients under inadequate supervision. Smith (68) favors conservative treatment for carbuncle on the back of the neck, rarely practices crucial incision or excision, and prefers to secure drainage by chemicals, carbolic acid, or potassium hydroxide, or by multiple cautery punctures, using nitrous oxide or a small dose of avertin for anesthesia. Carbuncles elsewhere than on the face or neck, he believes, may be incised or excised. Urbach (73) has reported an interesting case of phagedenic ulcer of the skin on the basis of skin diabetes. Without a history or signs of injury, a skin lesion on the chest went through the stages of furuncle, eczema, pruritis, and sweat-gland abscess; the ulceration reached the size of a saucer and resisted treatment. Classical symptoms of diabetes were absent; the urine was sugar-free and the fasting blood-sugar level was normal. A glucose-tolerance test revealed a diabetic curve and that the fasting-sugar content of the skin was high. Insulin and carbohydrate restriction effected a cure. In cases of "hospital gangrene" a similar cause should be ruled out. San Miguel (63) described a case of gaseous gangrene of the penis in a diabetic that was rapidly fatal after eight days of previous neglect.

Gangrene, particularly of the lower extremities, is the most common, serious surgical complication. Its increased frequency is due to the fact that the life expectancy of diabetics has increased. Gangrene stands next to coma as a preventable cause of death. Samuels (61) warns that arteriosclerosis obliterans plus diabetes is a serious condition requiring intensive treatment as soon as the diagnosis is made. The prevention of gangrene is possible if the diagnosis of deficient circulation is made in its incipient stages and proper treatment is instituted at once. Warthen (76) emphasizes the importance of care in hygiene of the feet on the part of every diabetic and suggests that a printed list containing simple rules outlined years ago by McKittrick and Root be given to each diabetic patient. Unnecessary amputations or premature death may result from neglect of apparently trivial injuries or lesions of the feet. Because of its wide prevalence and frequent recurrences, ringworm of the feet is a particular danger. Kelly (40) points out that inasmuch as the epidermophyton fungus primarily invades the tissues and thereby opens an avenue for secondary infection, a thorough understanding is essential of its sources, repeated possibilities of exposure, characteristic clinical lesions, histopathology, and associated allergic manifestations in order to prevent gangrene in diabetic patients. Fonseca's vaccine is reported to have been of material aid in the successful management of 30 cases of dermatophytosis in diabetics.

Conservative treatment of gangrene is often successful, according to Samuels (61), provided meticulous care is given to the local condition with due regard for sepsis and antisepsis. Complete rest is imperative at the first sign of impending gangrene. It is advisable to prohibit the use of alcohol in all forms. The object of local treatment is to prevent, if possible, the development of secondary infection in the gangrenous area. Every precaution and care should be taken in dressing and handling the involved parts. If there is considerable infection, wet dressings are preferable. The natural heat of the entire extremity can be readily preserved by wrapping the entire limb in a soft, warmth-retaining covering, such as cotton or lamb's wool. Intravenous injections of hypertonic saline solution (2 or 3 per cent) cause an immediate increase in the peripheral pulse amplitude and stimulate the collateral circulation. If there are no contraindications, such as serious myocardial damage, nephritis, or hypertension, saline injections may be given three times a week in amounts of from 200 to 300 c.cm. Sandstead and Beams (62) have reported observations before and after the oral administration of sodium chloride on 13 diabetic patients with pain of neuritic origin in 10, and of arteriosclerotic origin in 3. Daily from 0.25 to 0.5 gm. per kgm. body weight of sodium chloride in solution was sipped over a period of half an hour three or four times during the day. All of the patients obtained complete or marked relief of the neuritic symptoms. Those with arteriosclerotic pain showed signs of improvement of the vascular disease; in those with neuritic pain the cutaneous test described by de Takats showed improvement of the circulation. The results obtained suggest that ischemia due to primary arteriosclerosis is responsible for the neuritic symptoms.

The indications for radical amputation are mainly, according to Samuels (61), uncontrollable spread of the gangrene to the extent of destruction of the weight-bearing part of the foot and spreading infection that cannot be controlled by incision and drainage or other surgical measures. White (80) recommends that a "diabetic team" take

charge of the patient, the medical member to conduct a general study and to bring the diabetes under control, while the surgeon investigates the circulation of the extremity. The presence or absence of arterial pulsation in the dorsalis pedis, posterior tibial, popliteal, and femoral arteries is noted; the oscillometer and, finally, the McClure-Aldrich test are used. A thermostat skin study may be of some value. If the circulatory tests indicate that the advanced arterial disease is well localized in a gangrenous toe, local amputation at the metatarsophalangeal joint may be considered. Although sometimes successful, simple amputation of the toe is more often insufficient. Williams and O'Kane (83) report a five-year study of 496 cases of surgical diabetes. Following an arrangement whereby every patient was treated by the same surgeon in co-operation with an internist, the mortality rate fell from 50 to 20 per cent. In severely infected lesions of the extremity thigh amputation is preferred. Careful asepsis is important and includes scrubbing of the skin with water, soap, and alcohol forty-eight hours before operation, wrapping of the extremity in sterile towels, and a repetition of the scrubbing after twenty-four hours. By means of such aseptic precautions, together with most careful tissue-sparing surgical technique and postoperative care by the internist, most favorable results can be anticipated.

In deciding upon the site of amputation the surgeon must consider the pathological process, the level of effective collateral circulation, and the prosthetic requirements. The latter are, however, of subordinate importance. White (80) advises amputation from the middle of the leg upward whenever any procedure more radical than toe amputation is necessary. If the circulation is sufficient the middle third of the leg is the site of election; if amputation through or above the knee is indicated the lower third of the femur is selected. Drainage of the wound is carried out. Wills (84) favors amputation through the mid-thigh but, in selected cases, uses the Callander modification of the Stokes-Gritti operation which neither exposes nor injures the muscle bellies. In infected cases showing advanced lymphangitis, a guillotine amputation above or below the knee may be a definitely life-saving procedure. The patient's ability to walk later should not be given too much consideration if the life expectancy is short and if a subsequent, higher amputation might become necessary. Drainage has not recently been employed by Wills. Samuels (61) considers simple, circular amputation through the lower third of the thigh with tight closure of the stump and no drainage as the procedure of choice. Smith (68) favors a modified guillotine technique of an amputation through the lower third of the leg. Twenty-two amputations through the leg for diabetes between 1930 and 1937 resulted in a mortality of 18.1 per cent. In contrast, 50 amputations, most of them through the thigh, between 1916 and 1927, showed a mortality of 45 per cent.

In amputations for gangrene the use of a tourniquet and local anesthetics is contraindicated. Smith prefers nitrous oxide and Wills spinal anesthesia. The average, well treated diabetic needs no special preparation for operation. The presence of infection increases the insulin requirement. It is not necessary for the blood sugar to be normal or the urine sugar-free. Neglected or dehydrated patients require appropriate measures. Following operation frequent urine tests furnish a guide as to insulin dosage.

Arnell (3) has reported 117 cases of diabetic gangrene treated during the period from 1910 to 1934 in the Maria Hospital in Stockholm. Forty-five of the patients were females and 72 males. During the last ten-year period there was a definite increase in number, ascribed to the increased longevity of diabetics. In 28 per cent healing ensued after expectant treatment; in 22 per cent after minor operations, such as incisions and toe amputations. It is concluded, therefore, that treatment should, as far as possible, be conservative. Gangrene with infections, chills and fever, and troublesome ache in the gangrenous, pulseless foot are indications for major amputation. As a major amputation that of the thigh is recommended as amputations below the knee rarely result in healing by first intention. The mortality for all cases was 27.4 per cent and after major amputation 38 per cent. The most common causes of death were cardio-arteriosclerosis, sepsis, lung embolism, and bronchopneumonia, in the order mentioned. The primary operative mortality was not particularly high. Zucha (87) has reported a statistical study of 100 cases of diabetic gangrene. The average age of the patients was sixty-two years. The mortality was 32 per cent, with septicemia the most common cause of death. It was anticipated that more complete and rapid preparation for operation would lower the mortality rate.

BIBLIOGRAPHY

1. Allen, F. M. New England J. Med., 1938, 219: 77.
2. Allen, F. N. Surg. Clin. North Am., 1937, 17: 743.
3. Arnell, O. Acta chirurg. Scand., 1938, 80: 468.
4. Baudouin, A., Lewin, J., and Azérad, E. Presse méd., Par., 1938, 46: 729.

5. Bettica, R. Minerva med., 1938, 29: 20.
6. Bjering, T. Acta med. Scand., 1938, 94: 483.
7. Borromeo, G. Policlin., Rome, 1938, 45: sez. med. 301.
8. Bothe, F. A., and Beardwood, J. T., Jr. Ann. Surg., 1937, 105: 516.
9. Boulin, R. Presse méd., Par., 1938, 46: 137.
10. Boulin, R., and Kaufmann. Presse méd., Par., 1938, 46: 387.
11. Brahdy, L., and Kahn, S. Trauma and Disease. Philadelphia: Lea and Febiger, 1937.
12. Brandstrup, E., and Okkels, H. Acta obst. et gynec. Scand., 1938, 18: 136.
13. Bridge, E. M. Bull. Johns Hopkins Hosp., Balt., 1938, 62: 408.
14. Bugnard, L., Colombies, F. H., and Costes, A. Rev. de chir., Par., 1938, 57: 290.
15. Chabanier, H., Bréhant, J., and Donoso, R. Presse méd., Par., 1938, 46: 753.
16. Charbonnier, A., and Schauenberg, E. Rev. méd. de la Suisse Rom., 1937, 57: 711.
17. Davidson, C. F. Endocrinology, 1938, 22: 493.
18. Ducastaing, R., and Hautefort, L. Mém. l'Acad. de chir., Par., 1938, 64: 572.
19. Dunlop, D. M., and Pybus, R. Edinburgh M. J., 1938, 45: 415.
20. Edmondson, C. C. Wisconsin M. J., 1938, 37: 101.
21. Falta, W. Die Zuckerkrankheit. Berlin-Vienna: Urban and Schwartzenberg, 1936.
22. Glassberg, B. Y. J. Missouri State M. Ass., 1938, 35: 128.
23. Goodrich, C. H. New York State J. M., 1938, 38: 54.
24. Graham, G. Lancet, 1938, 2: 1, 62, 121.
25. Gratton, A. (a) L'Union méd. du Canada, 1938, 67: 471; (b) Bull. l'Ass. d. méd. de la langue franç. de l'Amérique du Nord, 1937, 3: 406.
26. Harris, S., and Harris, S., Jr. Am. J. Digest. Dis., 1938, 5: 88.
27. Hartmann, A. F. J. Iowa State M. Soc., 1938, 28: 1.
28. Herrick, W. W., and Tillman, A. J. B. Surg., Gynec. & Obst., 1938, 66: 37.
29. Himwich, H. E., and Fazekas, J. F. Am. J. M. Sc., 1937, 194: 345.
30. Holcomb, B. Am. J. Digest. Dis., 1938, 5: 127.
31. Hurwitz, D., and Irving, F. C. Am. J. M. Sc., 1937, 194: 85.
32. Introna, F. Policlin., Rome, 1938, 45: sez. med. 138.
33. Jackson, R. L., and Boyd, J. D. J. Iowa State M. Soc., 1938, 28: 1.

33a. Idem. J. Am. M. Ass., 1938, 111: 906.

34. Jenkinson, C. N., and Milne, K. J. G. Brit. M. J., 1938, 1: 380.
35. Jordan, W. R. South. M. & S., 1938, 100: 215.
36. Joslin, E. P. The Treatment of Diabetes Mellitus. Sixth edition. Philadelphia: Lea and Febiger, 1937.
37. Idem. J. Am. M. Ass., 1937, 109: 497.
38. Joslin, E. P., Dublin, L. I., and Marks, H. H. Am. J. M. Sc., 1938, 195: 596.
39. Joslin, E. P., Root, H. F., White, P., Marble, A., and Joslin, A. P. Med. Clin. North Am., 1938, 22: 711.
40. Kelly, H. T. Pennsylvania M. J., 1938, 41: 581.
41. Kitchell, J. R. Pennsylvania M. J., 1938, 41: 587.
42. Landesman, M. Polski przegl. chir., 1938, 17: 156.
43. Lavietes, P. H. Rhode Island M. J., 1938, 21: 5.
44. Lindsay, J. W., Rice, E. C., Selinger, M. A., and Misk, K. H. Virginia M. Month., 1937, 64: 507.
45. Locascio, R. Riforma med., 1938, 54: 693.
46. Mastrosimone, C. Policlin., Rome, 1936, 43: sez. chir. 622.
47. McCullagh, E. P. Ann. Int. Med., 1938, 2: 1979.
48. Meyler, L., and deMaar, A. Acta med. Scand., 1938, 94: 414.
49. Nadler, W. H., and Isaacs, B. L. J. Lab. & Clin. M., 1937, 23: 241.
50. Neuhoff, F. J. Missouri State Medical Ass., 1938, 35: 119.
51. Peters, J. P. Rhode Island M. J., 1938, 21: 1.
52. Piaggio-Blanco, R., and Sayagués, C. Arch. uruguayos de med., cirug. y especial., 1938, 12: 164.
53. Pijoan, M., and Zollinger, R. Endocrinology, 1937, 21: 357.
54. Ponteva, E. Ueber die Resultate der Diabetesbehandlung in Finnland, Helsinki: Mercatorin Kirjapaino, 1938.
55. Pratt, C. L. G. Proc. Roy. Soc. Med., Lond., 1938, 31: 971.
56. Priestly, J. B. J. Iowa State M. Society, 1937, 27: 402.
57. Ralli, E. P., Fein, H. D., and Lovelock, F. J. Am. J. M. Sc., 1938, 196: 28.
58. Rathery, F., and Froment, P. Bruxelles-méd., 1938, 18: 635, 670.
59. Root, H. F., and Marble, A. New England J. Med., 1938, 218: 918.
60. Sakharoff, G. P., and Rossiisky, D. M. Acta med. Scand., 1937, 93: 239.
61. Samuels, S. S. Surgery, 1937, 2: 225.
62. Sandstead, H. R., and Beams, A. J. Arch. Int. Med., 1938, 61: 371.
63. San Miguel, J. Semana méd., 1937, 44: 512.
64. Schoenbauer, L., and Dibold, H. Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1938, 45: 79.
65. Schur, H., and Pappenheim, E. Acta med. Scand., 1938, 95: 167.
66. Schwab, H. Presse méd., Par., 1938, 46: 140.
67. Sendrail, M., Cahuzac, M., and Garipuy, A. Presse méd., Par., 1937, 45: 1797; 1938, 46: 416.
68. Smith, B. C. Surgery, 1937, 2: 509.
69. Standard, S., Brandaleone, H., and Ralli, E. P. J. Am. M. Ass., 1938, 110: 627.
70. Stoerring, F. K. Med. Klin., 1936, 2: 1589.
71. Strauss, H. Acta med. Scand., 1937, 93: 526.
72. Titus, R. S. Am. J. Obst. & Gynec., 1937, 33: 386.
73. Urbach, E. Klin. Wchnschr., 1937, 2: 1315.
74. Vignes, H. Ann. méd.-chir., Par., 1938, 3: 243.
75. Violet, M. Rev. de chir., Par., 1938, 57: 54.
76. Warthen, H. J. South. M. & S., 1938, 100: 212.
77. Warvel, J. H., and Shafer, M. R. J. Indiana State M. Ass., 1938, 31: 4.
78. White, P. South. M. J., 1938, 31: 15.
79. Idem. Am. J. Obst. & Gynec., 1937, 33: 380.
80. White, W. C. Surg. Clin. North Am., 1938, 18: 353.
81. Wilder, R. M. Arch. Int. Med., 1937, 59: 329.
82. Ibid., 1938, 61: 297.
83. Williams, F. W., and O'Kane, T. J. Surg., Gynec. & Obst., 1937, 64: 956.
84. Wills, I., and Gray, P. A. California & West. Med., 1938, 48: 16.
85. Young, F. G. Lancet, 1937, 2: 372. Bio-Chem. J., 1938, 32: 513, 524.

85a. Idem. Bio-Chem. J., 1938, 32: 513, 524.

86. Zubiran, S. Gac. méd. de México, 1938, 68: 1.
87. Žucha, J. Časop. lék. česk., 1937, 76: 1301.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Robins, C. R.: Direct Inguinal Hernia. *Ann. Surg.*, 1938, 108: 389.

Robins reviews the development of the technique for repair of inguinal hernia from the year 1884, when Bassini devised his operation, up to the present time. Bassini stated that the principle of his operation was to reconstruct the inguinal canal after the manner of its physiological formation. A canal with an abdominal and subcutaneous opening and two walls is provided. Under the influence of abdominal pressure the posterior wall is pressed against the anterior wall, and both support each other to withstand continuous and strong impulses. Prominent among surgeons who have modified or developed new methods for the repair of inguinal hernia are Halstead, Ferguson, McArthur, and Andrews.

Modifications have always been directed toward the prevention of recurrences. Robins believes that the chief reason for recurrence is the absence of a well formed conjoined tendon and an attenuation of the muscles that form it. The object of his article is to point out the difficulties encountered in effecting a cure of direct hernia, and to present an operative procedure by which he has been able to effect cures in 100 per cent of 27 operations. As is well known, most recurrences occur in the lower angle and, as Robins points out, dissection will show that the conjoined tendon is absent at the pubic end of the inguinal canal, and that the internal oblique and transversalis muscles pass over directly to the rectus sheath and leave a defect from the lower border of the internal oblique muscle to the pubic bone. Attempts to close this defect by the ordinary methods of suture are not uniformly successful. Overlapping of the external oblique fascia is not successful because the pillars of the ring at this point are fixed by their insertion into the pubes. Sutures applied under tension are either cut out or absorbed.

The use of fascial sutures was first reported by McArthur in 1901. Gallie and Le Mesurier did much to develop the use of fascial sutures. They preferred to use fascia transplanted from the thigh, which procedure, Robins believes, complicates the operation unnecessarily. The steps in the operative procedure which the author recommends are as follows:

1. Incision is made down to the aponeurosis of the external oblique muscle in the direction of its fibers, and sufficient dissection is done to give wide exposure of the aponeurosis.

2. The external spermatic fascia is dissected from the border of the external ring and the inguinal canal is opened by incising the aponeurosis from the external ring to the belly of the external oblique.

3. If a sac is present, it is removed.

4. Fascial sutures are secured from the medial and lateral flaps of the external oblique aponeurosis. Care must be taken to preserve the strong attachment of this fascia to the pubes.

5. Suturing with the medial strip is done first. The fascial suture is passed first through the sheath of the rectus muscle, then over the cord, and through the fascia covering the pubic bone. The fascial stitch is then continued upward to suture the internal oblique muscle and transversalis fascia to Poupart's ligament.

6. The second fascial suture derived from the lateral flap is used to suture the lateral margin of the external oblique fascia to the opposite leaf of fascia.

This operation protects the external ring even more efficiently than normal insertion of the conjoined tendon.

Robins includes a detailed report of the cases of 23 patients with 27 operations, as 4 patients had double hernias. These cases have been observed over a period of from five months to four years, and no recurrences have been found. EARL GARSIDE, M.D.

Kross, I.: An Experimental Investigation of Evisceration. *Am. J. Surg.*, 1938, 41: 462.

The author made a clinical study of postoperative evisceration in which the various theories of the mechanism of its production were presented and analyzed. As a result of his findings, the following conclusions were made: "... no one single factor by itself is solely responsible for all cases of evisceration ... this condition is one brought on by a combination of events, in which any single one may by itself be insufficient, but which, combined with others, may produce wound rupture. The results of the experiments of Freeman, King, and the author, and the frequent findings of a partial wound rupture with healing of the rest of the wound, justify the assumption that, in all probability, the one most important factor is a defect in the closure of the peritoneum."

To test this hypothesis the following experiments were carried out in the pathology laboratory of the Beth Israel Hospital, New York. Adult rabbits were used. Under nembutal anesthesia and by means of the customary operating-room aseptic technique, an abdominal incision of from 1½ to 2 in. long was made transversely in some, and longitudinally in others. The wound was then closed. Silk was used for suture material. The peritoneum and muscles were closed in a single layer and the skin edges united with a second layer of sutures. In some animals one angle of the wound was left open for a distance of about 0.5 cm. In others the wound was sutured loosely so that the peritoneum was not approximated accurately, an attempt being made to simulate the closure in the human being when the patient is straining and when small tears of the peritoneum occur. The animals were sacrificed at intervals varying from two to thirty-six days, and the abdominal wall was examined after it had been incised circumferentially at

a considerable distance from the original incision in order to avoid any disturbance of the findings at the site of operation. The results are shown in Table I.

TABLE I.—RESULTS FOLLOWING EXPERIMENTS

Number of operations	16
Definite evisceration	6 (37½ per cent)
Adhesion to abdominal scar	7 (43¾ per cent)
Negative findings	3 (18¾ per cent)

In 6 animals there was found within the abdominal wall a definite gap into which the intestine had prolapsed, and which had thus formed a definite evisceration. In 7 instances the findings consisted of firm adhesions of the omentum or the intestine, or both, to the scar of the abdominal incision, which had, however, closed completely. In the remaining 3 cases no abnormal status obtained. From these findings it is to be noted that at times the abdominal wound, in spite of the deliberately formed openings, closed completely before any of the abdominal viscera could find their way in, and even before any adhesions could be formed. On the other hand, in most instances (81 per cent) the abdominal viscera either attached themselves to the opening or actually found their way into it, and thus produced definite evisceration or firm postoperative adhesion with the scar. These experimental findings are in accord with the clinical findings of King in his investigation of postoperative hernia.

It seems quite reasonable to maintain that postoperative adhesions to the abdominal scar, postoperative incisional hernia, and postoperative evisceration are differences in degree only of the same pathological phenomenon, and are due in all probability to the same factor: incomplete union of the peritoneum following inadequate closure.

J. Thornwell Witherspoon, M.D.

Whipple, A. O., and Elliott, R. H. E., Jr.: The Repair of Abdominal Incisions. *Ann. Surg.*, 1938, 108: 741.

The repair of abdominal incisions presents particular problems not encountered in other wounds or other regions. These may be analyzed under the following headings:

1. The peculiar arrangement of the flexing and rotating muscles and the aponeurotic layers entering into the complex functions of the muscles of the abdominal wall.

2. Repaired abdominal incisions, especially those in the upper abdomen, are subject to stress and strain as a result of vomiting, coughing, hiccough, distention, and the lifting and moving of the patient.

3. Abdominal incisions are more frequently contaminated with virulent aerobic and anaerobic organisms than any others. Activated enzymes at times are in contact with drained incisions in patients requiring intestinal repair, and are followed by fistulas. In such cases, not only is wound healing inhibited, but actual digestion of the tissues and dissolution of the sutures may occur. Disruptions and ventral hernias occur most frequently in such wounds.

Fig. 1. (Six day wound, catgut on the left side, silk on the right side.) All silk fibers are separated by an ingrowth of fibroblasts and giant cells. In striking contrast there is no growth immediately around the catgut, which is surrounded first by a pool of exudate, then degenerated muscle, and then by granulation tissue on the outside of this. This is a very striking contrast. Note the difference in the thickness of the wall on the catgut and silk side, due to excessive edema of the tissues where catgut was used. (Courtesy of J. B. Lippincott Co.)

4. In many elderly or cachectic patients suffering from prolonged malnutrition and vitamin deficiencies, and requiring extensive resections of neoplasms from the gastro-intestinal tract, the low serum protein content of the blood and tissues prevents normal healing and unquestionably predisposes to wound disruption.

Because of the factors mentioned above, many surgeons employ heavy material for the repair of the abdominal layers and for tension or reinforcing sutures. A microscopic study of sections of wounds repaired under tension and with heavy materials reveals long transverse lines of tissue necrosis on each side of the repaired incision. Necrosis takes place until the tension between suture and tissue is relieved. This tension, often resulting from the use of a continuous tight suture, diminishes the blood supply to the very tissues in which the surgeon is attempting to encourage wound healing. Because of the fear of wound infection and sinus formation, catgut rather than non-absorbable sutures are used by most surgeons in abdominal work. In wounds contaminated with lower ileal or colonic contents, non-absorbable sutures should not be used, but in such wounds, and in those in which activated pancreatic ferments are apt to be present, catgut has serious drawbacks. The irregular and early absorption of both plain and chromic catgut sutures in such cases has been noted clinically and demonstrated experimentally. In addition, in patients allergic to catgut, the local reaction predisposes to infection and favors wound disruption.

The authors' technique in closing abdominal wounds may be outlined as follows:

In incisions contaminated with ileal and colonic contents, an abscess, if present, is drained with one or more soft rubber tubes or cigarette drains introduced through a small opening in a china silk tampon. The peritoneum is closed with interrupted No. 00 chromic catgut sutures about the drains and the

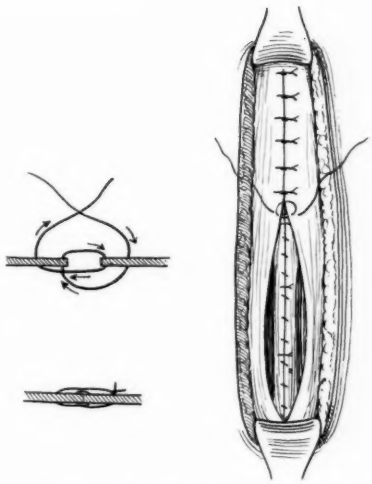

Fig. 2. Closure of the anterior rectus sheath with "far-and-near" interrupted fine silk sutures.

wound is packed with weak iodoform or zinc peroxide gauze around the drains inside the silk tampon. No attempt is made to suture the muscles, subcutaneous tissues, or the skin. If an abscess is not present, but the wound edges are contaminated with ileal or colonic contents, as in an open resection, a small Penrose drain is placed near the site of intestinal repair, the peritoneum is closed about it, and at least the central part of the wound is tamponed as in the case of an abscess.

In the repair of clean abdominal wounds, the authors tend more and more to employ fine silk. Catgut and silk should not be used together as catgut favors the growth of bacteria in the wound; and in an infected wound silk, unless very fine, is apt to act as a foreign body and result in the formation of sinuses.

In upper abdominal operations, the type of incision is determined chiefly by the width of the intercostal angle, the transverse incision being employed in wide-angled obese patients, and the split rectus incision in narrow-angled thin patients. Transverse incisions are preferred.

For closure of transverse and vertical incisions in the upper and lower abdomen the peritoneum and posterior rectus sheath or transversalis fascia are united with a continuous fine C silk or No. 00 chromic catgut, followed at 2 cm. intervals with interrupted sutures. The anterior rectus sheath and oblique muscle (in the transverse incision) are repaired with the same fine silk or chromic catgut by the use of a vertical figure-of-eight or "far and near" stitch at intervals of from 7 to 8 mm. These sutures are tied loosely, and because of lack of tension do not cut through or cause necrosis. No subcutaneous sutures are employed. The skin is closed with interrupted silk sutures on separate cambric needles in order to prevent contamination by repeated puncture of the skin with the same needle and the same long suture. No retention sutures are employed.

In a control series of 300 cases, in which the abdominal layers were closed with catgut, and heavy retention sutures tied over pearl buttons were employed, the incidence of wound infections, disruptions, and postoperative hernias was substantially greater than in a series in which the technique described above was employed.

ARTHUR S. W. TOUROFF, M.D.

Windfeld, P.: Circulatory Problems in Peritonitis. *Acta chirurg. Scand.*, 1938, 81: 293.

Windfeld calls attention to a number of notable reports made in recent years concerning the circulatory problems in peritonitis, which throw new light on obscure features, and which must therefore exercise a modifying effect on our conception of the pathogenesis of the disease. Experimental research into the circulation of the portal vein under normal and pathological conditions has given us important information as to what circulatory disturbances we may expect to find in peritonitis. The rhythmic movements of the intestine appear to influence the circulation in the portal system, but strong emphasis must be laid on the probability of separate movement of the intestinal mucous membrane, which constitutes another important motive force hitherto ignored. The rise of the blood pressure occurring in connection with peritonitis is a consequence of the meteorism, and is accounted for by the compression of the intestinal capillaries, with the contingent reduced passage of blood through the portal system.

The meteorism develops in the incipient stage of peritonitis at a time when we have no dependable evidence, either experimentally or clinically, of a circulatory insufficiency with stasis in the portal system.

The tardy fall in the blood pressure and the circulatory insufficiency are due to a universal capillary paresis which is particularly pronounced in the musculature, for instance, and which denotes a general intoxication of the disordered organism.

We must therefore conclude that collapse appears very late in the picture of peritonitis, and that "the heart cannot expect to find the fugitive blood" (to use Lichtenberg's simile) in the splanchnic blood vessels, but has to seek it everywhere in the dilated capillaries of the peripheral circulation.

CARL R. STEINKE, M.D.

Costa, L.: A Case of Mesenteric Cyst (Sopra un caso di cisti del mesentere). *Riforma med.*, 1938, 54: 1012.

Costa observed the case of a five-year-old boy who, when seen at the clinic, presented the picture of an acute abdominal involvement. The mother stated that this child had suffered similar attacks previously, especially in the winter. The individual

attacks were characterized by abdominal pain, vomiting, and marked prostration.

Upon examination there was found a marked tenderness over the right lower abdominal quadrant accompanied by a pronounced abdominal rigidity. On the basis of these findings, immediate surgical intervention was recommended.

Under ether anesthesia, a right pararectal incision was made extending from the inferior margin of the last rib to the bisiliac line. When the peritoneal sac was opened, a seropurulent fluid escaped and a diffuse hyperemia of the serosa was noted. There was also found at about the middle portion of the ileum a bilobate tumefaction about the size of a seven-month-old fetal head. Aspiration of the cystic mass yielded a milky-white, odorless fluid containing ascarides. The cyst was removed and because of its intimate relationship to the intestine, a segment of small intestine 30 cm. long was resected and a laterolateral entero-enteric anastomosis was performed. The postoperative course was good and the child made an uneventful recovery.

The fluid removed at operation was cultured bacteriologically and a hemolytic streptococcus was isolated. Histological examination of the pathological specimen revealed the presence of a pseudocyst of the mesentery and chronic appendicitis.

Various classifications of cysts of the mesentery have been proposed. Bonaccorsi distinguishes mainly true cysts and pseudocysts. The latter appear very similar to the true cysts grossly, but on histological examination their walls are made up almost exclusively of connective tissue. Pseudocysts arise pathogenetically from trauma, hemorrhage, degenerative changes, and inflammation, and from other cystic tumors.

The symptomatology of mesenteric cysts is not well defined. At an early stage an abdominal tumefaction is often visible and this may be frequently associated with various gastro-intestinal disturbances such as nausea, abdominal distention, and constipation. The most important sign, however, is pain which appears intermittently and which is usually attributed to other conditions. This pain is, as a rule, due to torsion, to pressure, and to a reduction in the caliber of the intestinal lumen. If the cysts become large, the patient will complain of a marked abdominal distention, dyspnea, vomiting, crises of constipation and diarrhea, and sometimes urinary disturbances.

The prognosis is bad in untreated cases. Spontaneous recoveries are very rare. The diagnosis is made in the presence of an abdominal mass and by means of the x-ray film. The condition should be differentiated from: (1) retroperitoneal tumors; (2) pedunculated ovarian cysts; (3) intestinal tumors; (4) hydropic degeneration of the gall bladder; (5) cystic tumors of the pancreas; (6) pedunculated cysts of the liver and of the spleen; (7) neoplasms of the omentum and mesocolon, and (8) pelvic neoplasms.

The final diagnosis can be made only by an exploratory laparotomy.

Treatment is always surgical and the prognosis depends upon the presence of certain complicating lesions, such as adhesions, intestinal stenosis, and hemorrhage. The cysts should be removed and if necessary an intestinal resection followed by a laterolateral entero-enteric anastomosis should be performed. RICHARD E. SOMMA, M.D.

GASTRO-INTESTINAL TRACT

Bennett, T. I., Dow, J., Lander, F. P. L., and Wright, S.: Severe Hemorrhage from the Stomach and Duodenum: Criteria of Severity. *Lancet*, 1938, 235: 651.

The authors have made a study of gastric and duodenal hemorrhage for the past three years. The chief purpose of their investigation was to obtain accurate information regarding the prognosis, the cause of death, and the best method of treatment.

The authors limited their observations to severe cases. The severity of any case can be judged only when it is known how much blood has been lost and whether bleeding has ceased temporarily or permanently.

A patient may be deemed to have had a dangerous hemorrhage: (a) when there is a convincing history of the vomiting of a pint or more of blood or the passage of a large quantity of bright or changed blood per rectum; and (b) when, without obvious evidence of vomiting or passage of blood per rectum, the patient has collapsed and shows clinical signs of severe hemorrhage, such as a high pulse rate, a fall in the blood pressure, and, in more severe cases, a fainting attack or air hunger.

In the presence of such criteria, it may reasonably be assumed that a patient is suffering from dangerous hemorrhage, but a more definite degree of the severity of his state cannot be ascertained without data given by more precise observation. Such data are of extreme importance because the choice of treatment in each case must depend largely upon the severity of the condition. The need for blood transfusion or, in rare cases, surgery, can be determined only when the exact extent and rate of the blood loss are known, and this can be discovered only by estimation of the total volume of the blood.

The method employed for the estimation of blood volume was the dye method of Keith, Rowntree, and Geraghty. Congo red was the dye of choice. The cell volume was calculated from the plasma volume and the hematocrit readings; therefore, any error in the determination of the plasma volume was reflected in the cell volume.

The authors' series comprised 122 cases, and included the cases of several patients who were readmitted once, or even twice. The patients were divided into three groups and classified according to the lowest blood-volume figures obtained during their stay in hospital. Patients in Class I lost less than 20 per cent of their normal cell volume; patients in Class II lost from 20 to 50 per cent, and patients in Class III lost over 50 per cent. Thirty-three

patients were found to belong in Class I, 32 in Class II, and 57 in Class III. All patients, however, had been admitted because it was believed that their life was endangered by the hemorrhage.

Immediately after a very rapid and severe hemorrhage, an amputation of a section of the total blood occurs, which leaves the relative amounts of plasma and cells momentarily unchanged. Plasma volume and total cell volume are reduced by an equal fraction of the whole, the percentage of hemoglobin remaining unchanged. Fluid then passes into the blood from the tissue spaces to restore the plasma volume. In uncomplicated cases the total blood volume returns only as the lost cells are slowly regenerated. When the plasma volume is fully restored the hemoglobin percentage does not give an accurate measure of the blood lost.

In order to judge the severity of a case it must be known whether or not bleeding has ceased. It has been demonstrated that dilution of the blood by reconstruction of the plasma is the factor which brings about the fall in the hemoglobin percentage following hemorrhage, and that the varying speed at which this may be accomplished may give rise to a serious error if the hemoglobin percentage is accepted as a guide to the extent of the hemorrhage. The same process will create a still graver source of error if hemoglobin percentage is accepted as a guide as to whether hemorrhage has ceased or not. The total blood volume is the only certain guide. NORMAN C. BULLOCK, M.D.

Fallis, L. S.: Perforated Peptic Ulcer. An Analysis of 100 Cases. *Am. J. Surg.*, 1938, 41: 427.

This study, which is based upon 100 consecutive operations for perforated ulcer at the Henry Ford Hospital in Detroit in the period from June, 1917, to December, 1936, had for its primary objectives a consideration of the clinical factors which have a direct bearing on the mortality rate, and an evaluation of the various operative procedures. The author's material showed a definite seasonal variation. Thirty-three per cent of the perforations occurred in the summer months of June, July, and August, inclusive, which was more than double the percentage occurring during the months of December, January, and February. The author believes that the low incidence of perforation during the winter months and the high incidence during the summer months indicates the influence of diet on the perforation of peptic ulcer. His conclusion is that in the winter, when food is more concentrated and the amount of fluid is restricted, perforations occur less frequently than in the summer months when bulky meals predominate because of an increased consumption of vegetables and fruit, and the fluid intake is larger.

Occupation and the use of tobacco and alcohol were of minor significance, but trauma was definitely established as an etiological factor in 4 per cent of the patients. Two perforations occurred immediately after abdominal injury, and 2 in the course of fluoroscopic examination of the stomach after the ingestion of a barium meal. The old adage that "the most dangerous place for an ulcer to perforate is in the hospital," was substantiated by the author. The temperature and pulse rate were of minor diagnostic value, but the leucocyte count in most instances increased rapidly with a polymorphonuclear predominance. The intra-abdominal fluid was clear in only 2.1 per cent of all the cases. Aspiration would therefore be of value in doubtful diagnoses. In 36 patients, a bacteriological study was made of the content of the abdominal fluid at operation. Twelve, or 33.3 per cent, gave a positive culture and 24, or 66.6 per cent, gave a negative culture. The mortality of patients with positive cultures was twice that of the series as a whole.

The operative procedures were simple closure, and closure with omental reinforcement, in 83 patients. In this group there were 15 deaths, a mortality of 18.1 per cent. Closure plus gastro-enterostomy, excision plus pyloroplasty, excision plus gastro-enterostomy, or excision alone was done in 14 patients with 2 deaths, a mortality of 14.3 per cent. This low mortality is not considered significant, however, because more surgery was undertaken in only those patients who were considered better risks.

The principal cause of death was found to be peritonitis, and for this reason drainage was the rule. It is the impression at the Ford Hospital that in most instances the use of drains was a life-saving measure.

The total mortality was 20 per cent. One death was definitely due to an over dose of ethylene. Another death occurred in a patient whose condition was so poor that the operation had to be performed under a local anesthetic.

The greatest single factor favoring recovery from a perforated peptic ulcer is prompt surgical intervention. The mortality rate for the first ten years in this series was 62.5 per cent. The mortality for the second ten-year period decreased to 11.9 per cent. The last 19 operations in this series of patients have all been successful. Earlier operation and improved pre-operative and postoperative treatment are the factors responsible for this reduction in mortality, and they are considered signs of surgical progress. The pre-operative administration of intravenous fluids, spinal anesthesia, routine blood transfusions, and continuous gastric suction have played a major rôle in saving the lives of victims of this serious abdominal emergency. The authors believe that the pre-operative and postoperative management of the patient is of greater importance than the experience of the operating surgeon, an opinion that is substantiated by the fact that the majority of patients in the first group were operated upon by members of the permanent surgical staff, and the majority in the second group were operated upon by the resident surgeons. SAMUEL J. FOGELSON, M.D.

Eliason, E. L., and Thigpen, G. M.: The Effect of Perforation on Peptic Ulcer Results. *Am. J. Surg.*, 1938, 41: 419.

The authors' study of 70 cases of perforated peptic ulcer was undertaken in order to determine the end-

results following the various surgical methods used in the treatment of these cases. After reviewing the literature and showing the marked diversity of opinion concerning the treatment of choice in cases of perforated peptic ulcer, the authors review the results obtained at the Hospital of the University of Pennsylvania over the fourteen-year period from 1922 to 1936.

The first observation was that the time interval between perforation and surgical intervention was the most important factor affecting the immediate operative mortality. The immediate mortality in the cases of perforated gastric ulcers and perforated duodenal ulcers was the same, 21.43 per cent. Fifty-five patients recovered from their operations, 47 of whom could be followed up. Nine were followed up for less than one year after operation; 28 for from one to five years, and 10 for more than five years.

Of the patients with perforated gastric ulcer, 3 who were treated by simple closure are well, and 1, who was troubled with persistent ulcer distress, had a second perforation a year after the original operation. At this time a gastro-enterostomy was done in addition to the secondary closure. Four of the 5 patients who had closure of the perforation plus primary gastro-enterostomy remained well, and 1 complained of mild ulcer symptoms which were entirely controlled by diet.

Eighteen of the 21 patients with acute perforation of a duodenal ulcer were treated by simple closure. Twelve were completely relieved, and 2 were benefited; 4 had persistent ulcer distress and, of these, 1 experienced a second perforation three and one-half years after the first operation, which required secondary closure with gastro-enterostomy. The patient recovered and has remained well. Two of the patients in this group required a secondary gastro-enterostomy for pyloric obstruction and neither of them has any further symptoms at present. One patient has persistent severe symptoms of recurrent ulcer, which cannot be relieved either by diet or alkaline powders.

Of the 18 patients with acute duodenal perforation who were treated by closure plus primary gastro-enterostomy, 16 were followed up. Twelve have no further symptoms; 4 were not benefited and 2 of the latter now show evidence of jejunal ulcer. All 4 patients can be made comfortable by a restricted diet.

A comparison of the results of the 2 most frequently employed procedures, viz., simple closure of the perforation and closure plus primary gastro-enterostomy, showed that 15 of 25 patients treated solely by simple closure recovered and 2 were benefited; 4 were not benefited but could be cured by a secondary operation. The percentage of cure was 86.47 in this group. Sixteen of 22 patients who had been treated by closure plus gastro-enterostomy were well and 5 were benefited, but none of these 5 apparently required further surgery. Seventy-six and two-tenths per cent of the patients in this group were cured. SAMUEL J. FOGELSON, M.D.

Morley, J., and Bentley, F. H.: Late Results of Partial Gastrectomy for Peptic Ulcer. *Brit. M. J.*, 1938, 2: 645.

Sixty-seven patients in whom a partial gastrectomy had been performed were re-examined after a period of from four to sixteen years. The average time of re-examination was eight and one-half years post-operatively. These 67 patients did not represent a consecutive series, but included only those from a series of 130 patients who could be traced and were willing to return for study.

Fifty-eight of the 67 patients had undergone a Shoemaker's gastrectomy, and 9 had had a Polya gastrectomy. Fifty-two patients originally had gastric ulcer, 6 had both gastric and duodenal ulcer, 4 had gastric ulcer and a healed duodenal ulcer, 4 had duodenal ulcer, and 1 had an anastomotic ulcer. Thus, most of the patients originally treated had gastric rather than duodenal disease.

The group of 9 patients who had undergone a Polya gastrectomy were shown to have depression of gastric function with bile regurgitation and complete absence of free acid. The blood picture showed 5 to have microcytic anemia, and 1, macrocytic anemia. Six of the patients were in good health; 2 were in fair health, although with microcytic anemia; and 1 had been in good health until pernicious anemia developed. There was no postoperative ulceration.

The 58 patients who had undergone a Shoemaker's gastrectomy, were divided into two groups. Those in Group 1 showed marked depression of gastric function. There was a normal blood picture in 33, and a microcytic anemia in 12; 38 were in good health; 1 had been in good health for six years, after which period a gastric carcinoma developed; 6 patients were in fair health, and 4 of these had a microcytic anemia, but only 1 showed symptoms of ulcer.

The patients in Group 2 showed active gastric function, and free acid above 20 c.cm. N/10 was found to be present. The blood picture was normal in 12; a microcytic anemia, probably secondary to a pulmonary tuberculosis, was found in 1; the general health was good in 10; in 1, the general health had been good for seven years, after which time a carcinoma developed; and in 2 the general health was fair. One patient in the group with a high free acid value experienced a sense of epigastric uneasiness unless he ate frequently, and 2 had definite post-prandial pain.

It is interesting to note that a high percentage of anemia was present not only in the patients who had undergone a Polya gastrectomy, and who had de-depressed gastric function, but in practically all of the patients who had had a Shoemaker gastrectomy and showed depression of gastric function. This suggests that the cause of anemia may be associated with gastric hypofunction. The authors conclude that the rôle of hydrochloric acid in this connection has not been entirely proved, and that still another factor—that of rapid gastric emptying—may be of

greater significance since it causes incompletely mixed, under-digested food constituents to be hurried through the duodenum and the upper part of the jejunum, and in this way interferes with the absorption of iron. The cause of these microcytic anemias, therefore, may be a diminished absorption of iron, secondary to the depression of gastric acidity. This opinion is substantiated by the observation that considerable improvement is obtained in these postgastrectomy anemias by the administration of massive doses of iron. However, it was further noted that in patients in whom gastric acidity was not depressed there was a risk of further ulcer development. This led to the conclusion that when gastrectomy is performed for gastric ulcer the objective should be to construct a stomach which will prolong the gastric emptying time and lessen regurgitation of the intestinal fluids. It is the opinion that this goal is more readily obtained with the Polya gastrectomy. This conclusion, the authors repeat, applies only to the surgical treatment of gastric ulcer. In duodenal ulcer, where the risk of recurrence is much greater, a more destructive operation has definite advantages.

SAMUEL J. FOGELSON, M.D.

Wangensteen, O. H.: Acute Bowel Obstruction: Its Recognition and Management. *New England J. Med.*, 1938, 219: 340.

Of all abdominal colics, only intestinal obstruction is characterized by recurrent intestinal borborygmi as the acme of concurrent crampy, colicky pains of short duration. Only strangulating obstructions and obstructions secondary to an inflammatory condition show tenderness and rigidity. X-rays of the abdomen are useful in the demonstration of gas in the bowel and in localization of the obstruction in the small bowel or colon. Occasionally barium must be administered to localize the process accurately. Vomiting is characteristic of obstruction of the small bowel. It is uncommon or occurs late in colon obstruction, in which condition the competent ileocecal valve prevents this symptom. Persistence of gas in the colon after evacuant enemas, with a relatively mildly distended small bowel, upon x-ray examination suggests partial occlusion, while the absence of gas in the colon under such circumstances points to a complete obstruction. The diameter of the colon has been found to be the best guide as to the degree of its obstruction.

The general effects of intestinal obstruction are dehydration, dechlorination, and loss of blood, the same as in strangulating obstructions. The effect on the bowel wall is a gradual compression of the vessels in the wall by increased intraluminal pressure until the wall becomes permeable to organisms lying in the lumen. Sustained increases in intraluminal pressure can occasionally lead to perforation in the colon because of the usual competence of the ileocecal valve. This rarely occurs in the small bowel because of the decompression that is produced by vomiting.

Saline solution is specific for the dehydration and demineralization which occur as the result of high obstruction, but it is of small direct value in colon obstructions.

Blood transfusions are indicated for patients with strangulating obstructions, in whom a rapid pulse indicates a severe blood loss, and in whom there is a marked transudation of fluid from the portal system.

The inhalation of high concentrations of oxygen is believed to be of aid in the treatment of abdominal distention.

Strangulating obstructions are immediately surgical, but they may be treated as simple obstructions after release of the strangulating mechanism if the bowel is still viable. Mesenteric thrombosis or embolism, and all other conditions in which the bowel is not viable, should be treated only by exteriorization of the non-viable segment.

Simple obstructions, particularly of the adhesive type, frequently respond satisfactorily to suction applied to an indwelling duodenal tube. The addition of a balloon to this tube may expedite its passage into the lower reaches of the small bowel, but it usually makes passage through the pylorus slightly more difficult.

The choice of operative procedure for obstructions of the small bowel should be the simplest procedure possible—i.e., enterostomy. The author cautions particularly against evisceration, dissection of loops of bowel from adhesions, and entero-anastomosis.

For simple obstruction of the colon, the author recommends a decompression operation, preferably in the transverse colon if this is possible.

THOMAS C. DOUGLASS, M.D.

Wheeler, D.: Diverticulum of the Duodenum. *Canadian M. Ass. J.*, 1938, 39: 214.

Diverticula of the duodenum are classified as primary and secondary. A primary diverticulum is one which occurs without any obvious cause; its wall is formed by the mucosal and submucosal coats. These diverticula are found in the second, third, and fourth portions of the duodenum. Secondary diverticula are considered as having an obvious cause. These are found in the first part of the duodenum and their walls are made up of all the coats of the intestine.

The following table shows the incidence of duodenal diverticulum as found by several workers on cadaver or post-mortem material:

TABLE I.—PERCENTAGE OF ALL TYPES OF DIVERTICULA FOUND POST MORTEM

Author	Post mortems	Cases of diverticulosis	Percentage
Linsmayer	1,367	45	3.3
Baldwin	105	15	14.2
Grant	37 (cadaver)	6	16.0
Grant	133 (cadaver)	15	11.3

Table II indicates the frequency of the condition discovered by roentgen examination:

TABLE II.—FREQUENCY OF SUCCESSFUL ROENTGEN EXAMINATION

Author	Cases examined	Cases diagnosed as diverticulosis	Percentage
Case	6,847	85	1.2
Andrews	2,200	26	0.18
Spriggs and Marxer	1,000	38	3.8
Cryderman	770	40	5.19
J. C. McMillan (quoted by Maclean)	653	10	1.5

Secondary diverticula occur in the first part of the duodenum and are the result of scarring and contraction due to an ulcer with pouch formation, this pouch being the diverticulum. This obstruction of the duodenal cap, which is due to scarring, causes a stenosis, and if the obstruction is of sufficient severity the proximal portion of the cap will dilate. This type of diverticulum will have all the coats of the bowel remaining in its wall. Since the diverticulum is the result of an underlying condition, e.g., ulcer, it gives no symptoms. Most patients have, therefore, been treated by operation designed to cure the primary trouble.

Primary diverticula have the following characteristics: (1) they are found only in the second, third, and fourth parts of the duodenum, the most frequent site being the second portion; (2) they are found on the inside of the duodenal loop and are, therefore, in relationship to the head of the pancreas; (3) they are often multiple, when they are usually seen as goblet-shaped protrusions of the mucous membrane communicating with the lumen of the duodenum by a narrow neck; (4) they vary in size, from that of a small pea to that of a small walnut; and (5) they are more frequently seen after the fifth decade.

The author discusses the various theories which attempt to explain the cause of these diverticula. In the main, these theories suggest the condition to be either acquired or congenital.

There are no definite signs or symptoms which are pathognomonic of these pouches. The history is usually of long standing. The patient complains of a feeling of heaviness and distention after eating, perhaps of nausea and vomiting, and sometimes diarrhea. The only method of diagnosis of these pouches is by use of the barium meal.

The author agrees with Odger's statement that "the great majority of these pouches do not cause any trouble, and since their demonstration by x-ray, their significance has probably been exaggerated." Maclean, however, maintains that in those cases in which there is a definite peridiverticulitis and pancreatitis from the embedding of these pouches in that gland, surgical removal offers definite promise of relief. However, it is customary to try medical treatment first, such as postural drainage and lubrication and disinfection of the diverticular pouch.

The case of a large traumatic diverticulum (probably secondary to damage of the duodenal wall during cholecystectomy) is reported.

JOHN H. GARLOCK, M.D.

Carabba, G., and Baccarani, C.: The Combined Excretion of Bacteria by the Tonsils and the Appendix (Ricerche sperimentali sulla funzione escretrice batterica associata tonsillo-appendicolare). *Ann. ital. di chir.*, 1938, 17: 571.

The coexistence of inflammatory processes of tonsils and appendix has been repeatedly noticed, but the importance of tonsillitis in the pathogenesis of acute appendicitis has not been sufficiently emphasized in spite of the anatomicostructural similarity between both organs. Rosenow demonstrated that bacteria injected into the blood of experimental animals could be found in the appendix and tonsils of these animals. The physiopathological interdependence of both organs represents an obscure problem and its demonstration is difficult.

The authors injected a suspension of four loops of a forty-eight-hour-old culture of staphylococcus albus in 2 c.cm. of a physiological saline solution into the marginal vein of rabbits, and killed the animals six, twelve, eighteen, or twenty-four hours after the injection. The entire Waldeyer's lymphatic ring and the appendix with the mesenteriolum were embedded in paraffin and studied histologically. No cultures were made because the presence of micro-organisms in the oral cavity or the lumen of the appendix would interfere with the results and, on the other hand, negative results of the cultures would not exclude the presence of bacteria in more deeply situated tissues.

The histological sections revealed the presence of the injected bacteria in the appendix and the tonsils. Apparently not all the bacteria injected were excreted by both organs because a certain number of them were found in the efferent vessels of the appendix and the tonsils. JOSEPH K. NARAT, M.D.

Shipley, A. M.: The Treatment of Peritonitis Complicating Appendicitis. *New England J. Med.*, 1938, 219: 333.

The knowledge of when to operate, and when and how to drain, constitutes the most important problem in peritonitis complicating acute appendicitis.

The author states that in this paper peritonitis which is not accompanied by gross rupture of the appendix is regarded as early, while the gross contamination which occurs after rupture is called late peritonitis. His study is based on 1,106 cases of acute appendicitis at the University Hospital in Baltimore, classified as follows:

Condition	Cases	Deaths
Chronic and recurrent appendicitis	479	2
Acute appendicitis without peritonitis	354	2
Early peritonitis:		
Thrombotic, gangrenous or suppurative cases—no drains	149	1
Same, except with drainage of abdominal wall only	28	0
Same, with intra-abdominal drains because of uncertainty of closure of stump of appendix	4	0
Late peritonitis:		
Localized	41	1
Diffuse	49	18

Patients with early peritonitis were treated by immediate appendectomy, with drainage of the abdominal wall after closure of the peritoneum. Also included in this group were a number of patients in whom rupture of the appendix had sealed off and had therefore seemed to constitute an indication for the same procedure.

So-called late peritonitis is not always a direct result of the time factor; cathartics, the obstructive type of appendicitis, and appendicitis in young children all tend to speed up the process. The severity of the process seems to depend on the type and number of micro-organisms which are present. The disease may be localized, diffuse, or subsiding.

Localized peritonitis may be so from its onset, or it may occur as the result of conservative treatment of a diffuse peritonitis. The author believes that the abdomen should be opened and drained and that no attempt should be made to remove the appendix as soon as localization seems well established.

Diffuse peritonitis of the late variety is probably best treated conservatively; that is, by Wangensteen suction, morphine (without atropine), the application of heat or cold to the abdominal wall, the control of dehydration and acid-base imbalance by means of large quantities of salt solution and glucose, and decompression of the colon with the enema tube.

The McBurney incision is used because of the need for fewer sutures, the prompt falling together of the tissues as the infection subsided, the absence of hernia or evisceration, and the easy access to the areas to be drained.

Drainage material should be soft and small, because hard drains cause necrosis and large ones have a tendency to plug up the opening.

THOMAS C. DOUGLASS, M.D.

Walker, I. J.: Immediate or Deferred Surgery for General Peritonitis Associated with Appendicitis in Adults. *New England J. Med.*, 1938, 219: 323.

Because of a mortality of 33 per cent in appendiceal general peritonitis in the Boston City Hospital, in the years from 1927 to 1930, the author became interested in the subject. The following classification of peritonitis was used: local peritonitis, abscess of the appendix, spreading peritonitis, and generalized peritonitis. The last type included only patients presenting a history of acute appendicitis and having a generalized spasm and tenderness of the abdomen.

The study includes 105 cases which came under the classification of generalized peritonitis and which were found among 5,371 cases of acute appendicitis which were admitted to the Boston City Hospital. Three cases were omitted from the study because of the moribund condition of the patient on arrival, or because of missed diagnosis. Seventy-seven patients were treated by immediate surgery, and 25 by deferred surgery. There were, in addition, 5 private cases treated by deferred surgery.

The mortality rate in the series of 77 patients who were immediately operated upon was 42 per cent. Fourteen of the 32 deaths occurred in the first twenty-four hours following surgery, which seemed to indicate that patients with outstanding toxemia might profitably be treated for such time as is necessary to improve the general condition before operating.

Therapy in the cases treated by deferred surgery consisted of the withholding of food and fluids by mouth or rectum, and the maintenance of the fluid and mineral balance by parenteral fluids, salt, and glucose. Wangensteen drainage was instituted in some cases. Blood transfusions were given for anemia, septicemia, or for prolonged sepsis. When peristalsis was spontaneously established, small and increasing amounts of fluid were allowed by mouth. Diarrhea was troublesome in a few cases and was common in the series. Two patients recovered without the formation of abscesses. In the remaining 28 patients there were 48 abscesses, 20 of which were located in the pelvis. In the 30 cases treated by deferred surgery there were 4 deaths. After all the symptoms of inflammation had subsided for a period of from three to four months, all appendices were removed for confirmatory evidence. The author believes that 23 of the 30 patients treated by delayed surgery were placed in a more favorable condition for surgery after treatment for from twenty-four to forty-eight hours, and that the remaining 7 patients were in a no more serious condition than they were on admission.

Deferred operation has no place in the treatment of the acute, unruptured appendix. It should be considered for those patients who are found to be desperately ill with fulminating peritonitis only when and if the surgeon is equipped in every way to carry out the necessary precedures.

THOMAS C. DOUGLASS, M.D.

Ladd, W. E.: Immediate or Deferred Surgery for General Peritonitis Associated with Appendicitis in Children. *New England J. Med.*, 1938, 219: 329.

The author notes the increasing mortality attributed to appendicitis and cites the negligible mortality associated with early operation as an imperative reason for making a serious study of the dilemma of late diagnosis and delayed operation.

He carefully outlines the usual symptoms of the disease and the accepted routine for examining a child so as to obtain the most accurate information possible. The prohibition of cathartics is stressed. The laboratory findings and the differential diagnosis as they apply specifically to children are reviewed.

The question of immediate or delayed surgery is believed to be entirely a surgical one. The Ochsner treatment is outlined, and it is stated that partly because of a shorter omentum and possibly because of other factors, a process in the abdomen does not localize as well in children as it does in adults.

The procedure at the Children's Hospital of Boston is to operate on all patients as soon as they can be properly prepared. The delayed operation is reserved for the occasional profoundly toxic, dehydrated, distended patient with sunken eyes and a rapid, feeble pulse. In such cases the operation is performed after preparation for a day or so with parenteral fluids, decompression, and other measures.

The right rectus incision is used, except in the few cases in which the appendix seems lateral to the cecum. The appendix is not always removed. Drains are usually placed in the iliac fossa and the pelvis, and are left in place for about a week. Postoperative care consists in placing the patient in Fowler's position, and the use of parenteral fluids, morphine, and Wangensteen suction if postoperative distention or vomiting occurs. Oxygen up to 90 or 95 per cent is also used in those cases which show marked distention with some beneficial results.

In 632 cases of acute appendicitis the mortality was 3.5 per cent. In 204 cases of gross rupture of the appendix the mortality was 7.3 per cent.

THOMAS C. DOUGLASS, M.D.

Gilchrist, R. K., and David, V. C.: Lymphatic Spread of Carcinoma of the Rectum. *Ann. Surg.*, 1938, 108: 621.

The operability and prognosis in patients with carcinoma of the rectum depend on the presence and extent of lymphatic metastases, as well as on the degree of local extension of the tumor and the absence of blood-borne metastases to the liver, lungs, bones, and brain. The present study was undertaken in an effort to determine the incidence, extent, and location of lymph-node metastases and the extent of radical removal necessary to insure eradication of all involved nodes.

The authors developed a technique to study accurately all lymph nodes surgically removed with cancer of the rectum. Specimens studied in this way have had from 20 to 80 nodes per specimen.

The average number of nodes in 25 transparent specimens removed by the Miles type of abdominoperineal resection of the rectum was 52.1 nodes per specimen. Sixteen of the 22 specimens studied by gross dissection had lymph-node metastases, and 16 of the 25 specimens studied by the method of clearing had metastases, an average of 68.1 per cent of all specimens studied.

Tumors arising predominantly on the mesenteric border of the bowel seem to metastasize to the lymph nodes more frequently than those arising on the anti-mesenteric border.

The duration of symptoms seems to have less effect than one would suppose on the number of nodes involved in operable cases. Three patients who had had symptoms for four months or less had 22, 25, and 28 involved nodes, respectively, while 5 patients who had had symptoms for from twelve to eighteen months had 0, 2, 3, 2, and 43 involved nodes, respectively.

Analysis of the specimens studied has led the authors to the following conclusions:

(1) The size of the tumor has little bearing on the presence or absence of lymph-node metastases.

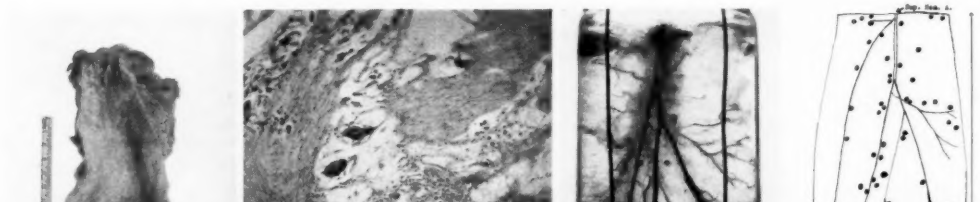

Fig. 1. Gross specimen and photomicrograph. A photograph of the cleared transparent preparation of this specimen shows the arterial tree as branching, black lines. The lymph nodes are represented by the spherical, dark areas seen throughout the tissue. The accompanying diagram shows the location of the lymph nodes. Those containing carcinoma are indicated by solid black dots. The normal lymph nodes are represented by hollow circles. (Courtesy of J. B. Lippincott Co.)

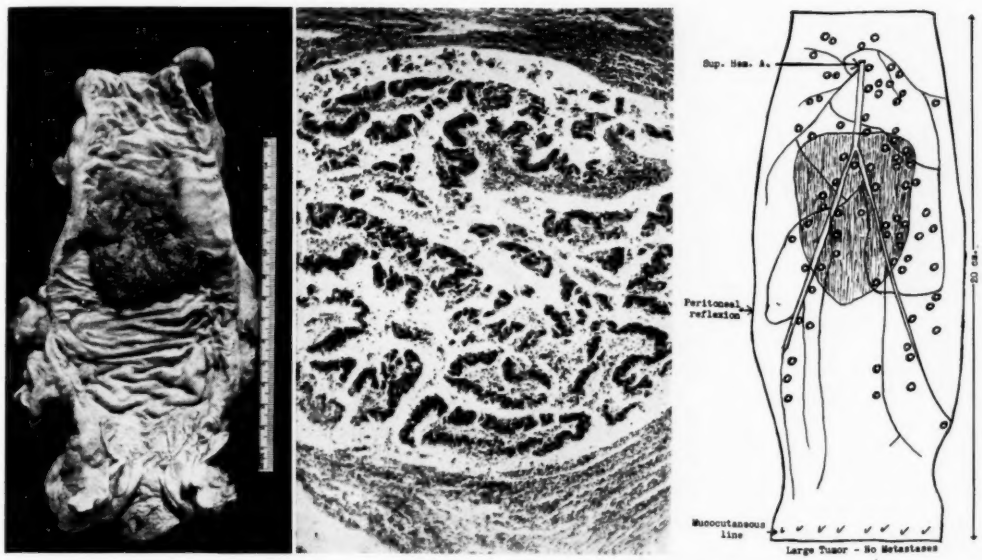

Fig. 2. Showing an instance of a large tumor without the occurrence of any metastases.

(2) Low-lying tumors may have very high metastases.

(3) When the upward lymph channels are blocked by metastases, there may be a retrograde metastasis downward.

(4) When the tumor is found at the level of the levator-ani muscle, there is double lymph drainage. The more common direction is upward along the superior hemorrhoidal artery; the other is laterally along the superior surface of the levator-ani muscle.

(5) Squamous-cell carcinomas which involve the mucosa may have a double lymphatic involvement.

(6) Post-mortem examination shows that radical removal with as high resection of the superior hemorrhoidal artery as possible and wide resection of the levator-ani muscles is necessary for the best chance of cure. NORMAN C. BULLOCK, M.D.

Eiken, T.: Radical Treatment of Carcinoma of the Rectum (Ueber die Radicalbehandlung des Rectumcarcinoms). *Acta chir. Scand.*, 1938, 81: 155.

The author attempts to evaluate the results of the different surgical procedures for carcinoma of the rectum in 1,444 cases gathered from the material in the clinics of the surgeons of Denmark in the years 1931 to 1935, inclusive. This material is peculiar in that not more than 300 cases of rectal carcinoma occur yearly in all Denmark and not more than 10 cases occur yearly in any one clinic. Danish operators, therefore, probably do not attain the finished experience of individual surgeons in other regions.

The mortality for the one-stage, combined abdominoperineal procedures for Denmark is 70.6 per cent; for the two-stage procedures the figure drops to 49 per cent; however, when the deaths following the first-stage operation are added and the cases in which the second stage was not carried out for any reason are taken into account the percentage rises to 64.5 per cent. The perineal, i.e., perineosacral, excisions exhibit a much lower mortality (27.6 per cent).

The Danish material is not believed to be of much value for evaluating late results, but in foreign countries, in which both the abdominoperineal and the perineal (perineosacral) methods are employed in extensive series by the same surgeon, the percentage of permanent, three to five-year, cures is not so different for the two methods. (For figures from European and American sources the reader must refer to the original article.) This percentage is also not very far from that figure which careful histological studies have indicated as representative of the incidence of involvement of the regional lymph nodes in these cases of rectal cancer. Therefore, it is thought that the perineosacral methods are practically as radical, in their recently developed forms, as the more extensive abdominoperineal methods.

The percentages of permanent cures reported from all sources would seem to encourage attempts at radical removal; however, it is believed that the perineosacral methods are preferable for all rectal cancers which are judged operable and are not situated above the upper limit of practicability for the perineosacral methods, 10 cm. above the anus. It is recommended that in Denmark all procedures be

two-stage with several weeks intervening between the first and second stages of the operation.

JOHN W. BRENNAN, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Boyce, F. F., and McFetridge, E. M.: Studies of Hepatic Function by the Quick Hippuric Acid Test. I. Biliary and Hepatic Disease. II. Thyroid Disease. III. Various Surgical States. *Arch. Surg.*, 1938, 37: 401, 427, 443.

The established functions of the liver include:

1. The metabolism of carbohydrates
2. The metabolism of proteins
3. The metabolism of bile
4. The coagulation of the blood
5. The detoxification of poisons, bacteria, and other harmful substances
6. The thermogenic function

At the present time, the majority of tests for hepatic function are highly unsatisfactory until the disease is so far advanced that the information which they supply is no longer necessary. The various tests of liver function which have previously been proposed may be classified under the headings of the various functions which they are intended to reveal.

Tests of carbohydrate function include the galactose test and the levulose-tolerance test. Both are based on the theory that in persons with hepatic dysfunction, the rate of utilization of a predetermined amount of carbohydrate will be slower than in normal persons, and therefore a greater amount of the substance will persist in the general circulation and be excreted in the urine. However, too many factors are involved in the mechanism of sugar metabolism to make the tests at all reliable, aside from the fact that there is a wide variation in the rate of utilization of dextrose by normal individuals.

2. Studies on nitrogen partition have proved of no particular value, because extremely severe hepatic damage is apparently necessary to cause any significant alteration in these values.

3. Tests of bile metabolism include the icteric-index test, the Van den Bergh test, the Fouchet test, the urobilinogen test, the test for bilirubinuria, and the bilirubin test.

The Quick hippuric-acid test possesses most of the advantages, and is free of most of the disadvantages of the tests previously employed. The synthesis of hippuric acid is a process of detoxification which is brought about by the conjugation of benzoic acid and amino-acetic acid. The product of the conjugation is eliminated in the urine as hippuric acid, except for a small fraction which is conjugated with glycuronic acid and eliminated as glycuronic acid monobenzoate. There is no store of preformed amino-acetic acid in the body. The liver has a maximum hourly synthesis of endogenous amino-acetic acid, and in the absence of an exogenous supply cannot produce more than this maximum amount to combine with the benzoic acid ingested. The rate of synthesis of hippuric acid is therefore governed by the ability of the organism to produce amino-acetic acid. Since the liver is the site of synthesis of this acid, it can reasonably be assumed that the synthesis will be adversely affected in the presence of certain types of hepatic damage and that the output of hippuric acid (which will be correspondingly diminished because of the lack of amino-acetic acid to combine with benzoic acid) will serve as an index of this damage.

The test is based on a normal physiological process, and therefore involves no strain on the liver. No conclusive proof exists, however, that the liver is the sole site of the synthesis of hippuric acid. If renal damage is also present, the hippuric acid is retained, as a nitrogenous product would be, and the test must be interpreted in the light of that fact. The hippuric acid test of Quick should always be checked by the urea clearance test of Van Slyke.

The unpleasant taste of the sodium benzoate which is administered can be overcome by the addition of a small amount of cherry syrup. A single test does not furnish adequate information as to the state of the liver.

Highly significant in the 82 cases of disease of the liver and biliary tract which were tested is the marked impairment in liver function after operation. The slow return to normal after cholecystostomy suggests the doubtful wisdom of prolonged drainage of the biliary tract. The results of the test show the importance of pre-operative preparation and postoperative care in cases of biliary disease.

Studies with the Quick test have made it clear that the premises on which dextrose has been used to bolster the liver are entirely sound. The effect on the hepatic function of its use and withdrawal is sometimes dramatic.

The relationship between hepatic function and urinary output is clear. The prognosis in cases of hepatic disease can be based on the occurrence or failure of spontaneous diuresis. Many explanations of the relation between hepatic and renal function have been advanced. The most probable explanation is that a lack of amino-acetic acid brings about a cessation of glomerular function. On this basis, it seems not unreasonable to assume that the liver, by means of the amount of amino-acetic acid released into the circulating blood stream, actually determines renal function. If this is true, the progressive oliguria passing over into anuria, which is the outstanding characteristic of the "deferred liver death" or "liver-kidney" syndrome, may be interpreted as due to a diminished synthesis of amino-acetic acid in the liver. Certainly, the improvement following the administration of decholin sodium, with the resulting improvement in the synthesis of amino-acetic acid and in the formation of bile salts, seems to support this view.

The important consideration is that a patient who exhibits a damaged hepatic function before operation, as manifested by a failure of synthesis of amino-acetic acid, becomes a doubly poor risk if he also pre-

sents signs of renal damage, such as a raised urea content in the blood and a low urea clearance.

The most common cause of postoperative delirium and disorientation after operations on the thyroid gland is hepatic failure. The sudden and extreme hyperpyrexia which may occur postoperatively and even pre-operatively, the jaundice which is sometimes slight and transient but more often deep and terminal, and the benefit produced in cases of thyroid disease by the measures ordinarily used to combat hepatic damage, all seem to establish this thesis. The actual pathological changes which are present in these cases at autopsy may be roughly classified as fatty infiltrative changes, degenerative changes ranging from those of a mild type to actual necrosis, cirrhotic changes, and acute yellow atrophy.

The results of the Quick test in the presence of hyperthyroidism show that the liver function undergoes a more frequent and more intense change than has been previously suspected. The changes in function correspond to the hepatic changes demonstrated pathologically and furnish an ample basis for explanation of the thyroid crisis. The degree of dysfunction is related to the clinical severity of the disease and to the degree of toxicity, as indicated by the basal metabolic rate and by the necessity for operation in stages. Improvement in function occurs with pre-operative preparation. There is no correlation between the hepatic function, as demonstrated by this test, and the duration of the disease or the amount of weight lost.

More should not be read into this test than it can tell. It interprets hepatic damage in terms of function. Repeated tests indicate alterations in function, but a single test and repeated tests tell nothing else. It is not an index of the type of risk represented by the patient with thyrocardiac disease, for whom the cardiac damage wrought by the hyperthyroidism is the outstanding consideration. The test is no index of possible respiratory failure or of any other complication except hepatic damage.

When dextrose is used as a postoperative measure in cases of the toxic type, there is a distinct decrease in the mortality from thyroid disease.

The rôle of the liver in all types of surgical disease is more important than is generally suspected, and it is as important to consider the liver in evaluating the surgical risk as it is to consider the heart, the kidneys, and the lungs.

In patients who undergo elective operations for conditions not connected with the biliary tract or thyroid gland (appendectomy and hernioplasty), there is a distinct impairment of hepatic function postoperatively. There is approximately a 25 per cent drop in hepatic function with ether anesthesia, and an even greater fall with spinal analgesia. It is least marked with ethylene anesthesia.

It is well to guard against this impairment of hepatic function, in even sound subjects, by such simple measures as the oral administration of carbohydrates, particularly dextrose, before and immediately after operation. It is wise to do this as a matter of routine because of the occasional unexpected death which follows even elective operations on supposedly sound persons. SAMUEL KAHN, M.D.

Brown, P. W., and Hodgson, C. H.: Late Results in the Treatment of Amebic Abscess and Hepatitis of the Liver. *Am. J. M. Sc.*, 1938, 196: 305.

Brown and Hodgson present a study of 35 cases (18 surgical and 17 medical) of abscess of the liver encountered during a period of eighteen years at the Mayo Clinic. The results of their study show that the infection occurs most frequently in middle-aged male patients. A syndrome of pain in the upper right quadrant of the abdomen, often referred to the shoulder, associated with fever, chills, leucocytosis, and possibly with diarrhea and jaundice, should suggest hepatic involvement and, if relieved by anti-amebic treatment, should be an indication of amebic infection.

The authors believe that the efficacy of the anti-amebic treatment can be measured partially by the remarkable results obtained in their relatively small series of 35 cases. A follow-up study of the late results in these cases revealed that 12 of the 14 medical patients, and 14 of the 18 surgical patients are apparently well at the present time. The nucleus of their treatment of this dreaded infection lies in their slogan: "Emetine to check the acute symptoms and arsenic to wipe out the amebas." They contend that the employment of this method is desirable as well as justifiable until another method which is just as effective and causes less toxicity is made available. EARL GARSIDE, M.D.

Impallomeni, R.: Cholecystography Performed with More Physiological Methods (Per una più fisiologica indagine colecistografica). *Radiol. med.*, 1938, 25: 583.

Impallomeni states that in the past few years many new methods have been devised to obtain a rapid roentgenological visualization of the gall bladder. These various studies and experiments were designed to eliminate the many difficulties involved in the interpretation of cholecystograms and in the comparison of these cholecystograms with the anatomicopathological findings.

Cholecystography in reality represents a test of the functional capacity of the liver. The principle is based upon the fact that the gall bladder definitely reflects the functional activity of the hepatic cells in response to the biligenetic action of the contrast substance.

Impallomeni recommends the intravenous administration of the contrast substance rather than the peroral because he believes that the gastro-enteric factor interferes markedly with cholecystography. In order to study this problem more completely, he performed Graham's test in a series of individuals who did not present any biliary pathology worthy of note. No cathartic or special type of diet was prescribed the day before the test, in order to render the

conditions as nearly physiological as possible. Under these conditions the shadow of the gall bladder began to appear about two hours following the injection. If bile salts were administered intravenously at the same time, the shadow of the gall bladder appeared as early as fifteen minutes following the injection.

The author's method of performing a cholecystography may be briefly summarized as follows: there are no special preparations to be observed on the day prior to the test. On the following morning the patient is kept in a fasting condition; a cleansing enema is given; and an intravenous injection consisting of 30 c.cm. of "Endocolefanine-Erba" and 10 c.cm. of "Didrocol-Recordati" is made slowly. The films are taken during the first and second hours.

In normal subjects the first film shows a well defined outline of the gall bladder. In the second film the gall bladder shadow appears denser. If the films obtained are not satisfactory another film should be taken after the fourth and after the fifth hours. In individuals presenting retarded biliary secretion of the liver or retarded absorption by the gall bladder, the greatest density of the shadow is observed at the fourth or fifth hour. In the majority of cases, however, the outline of the gall bladder can be visualized during the first and second hours following the intravenous injection. If no visualization can be obtained at the fifth hour a last film may be tried at the tenth hour, although in such cases the probabilities of visualization are very slight.

Because of the lack of experimental work no definite conclusions are drawn concerning the application of these principles to pathological cases.

Impallomeni also conducted a series of experiments showing that certain hepatic amino-acids not only have a marked biligenetic effect, but also exert a decided detoxifying action. With the aid of these amino-acids the gall bladder may be visualized as early as the first hour following the injection. The maximum density of the shadow is observed at the third hour. The author believes that the addition of these amino-acids also attenuates the toxic effects of the contrast substance. RICHARD E. SOMMA, M.D.

Copher, G. H.: The Surgical Treatment of Common-Duct Stones. *Surg. Clin. North Am.*, 1938, 18: 1369.

The author points out that the absence of pain in the presence of jaundice does not rule out the possibility of a stone in the common duct, as a considerable number of patients with this condition have absolutely no pain during their illness.

It is safer not to operate on a patient while the icterus index is rising, but to wait until the index maintains a constant level or is falling. The bleeding and clotting times of all patients with jaundice should be ascertained before operation. Patients with severe jaundice are very apt to bleed postoperatively in spite of normal bleeding and clotting times. Blood transfusions and glucose solution administered intravenously should be given pre-operatively. Donors should be available during the operation and postoperatively in case additional transfusions are needed.

To palpate the common duct the author goes to the left side of the operating table.

In general, the indications for exploration of the common duct are: (1) a history of jaundice, chills, and fever, (2) a thickening and enlargement of the common duct, (3) a thickening of the gall bladder, and especially an associated thickening of the head of the pancreas, (4) the presence of many small stones in the gall bladder and cystic duct, (5) the inability of the surgeon to determine whether obstructive jaundice is intrahepatic or extrahepatic in location, and finally, (6) the presence of definitely palpable stones in the common duct. The duct is identified by aspiration with a fine needle. After exploration and removal of the stones from the common duct, the duct is irrigated with saline solution to wash out sand or small stones. The papilla of Vater is dilated mechanically. The common duct is drained by a catheter introduced toward the hepatic ducts. The author does not consider it necessary to gradually decompress the biliary system after relieving complete obstruction of the common duct.

The gall bladder is not removed until after the surgery of the common duct is completed. The common-duct catheter and a rubber dam drain are brought to the surface through a stab wound. The drain is removed in four days. The catheter in the common duct is usually removed in from ten to fifteen days except when there is pus in the drainage or if deep jaundice was present pre-operatively.

If cholangiography is desired a 48 per cent solution of hippuran is preferred to heavy opaque oils for contrast material, as it is less likely to obscure small stones. EARL O. LATIMER, M.D.

Twiss, J. R., and Barnard, J. H.: Disease of the Biliary Tract Associated with Disturbances of the Cholesterol Metabolism. *J. Am. M. Ass.*, 1938, 111: 990.

Disturbances of the cholesterol metabolism, although generally conceded to be a major contributing cause in the formation of gall stones, are as yet little understood. Cholesterol is both exogenous and endogenous in source. Because of the partial exogenous source, the dietary treatment of disease of the biliary tract associated with hypercholesteremia is based on a two-fold hypothesis: (a) that hypercholesteremia may result from the excessive ingestion of foods which are high in cholesterol and fat content; and (b) that a reduction of cholesterol intake by patients having hypercholesteremia causes a decrease in the amount of cholesterol in the blood. It may be stated that a relative increase in the cholesterol concentration of the gall-bladder bile, particularly in the presence of infection or stasis, may result in the precipitation of cholesterol and the formation of stones.

The authors investigated a series of patients with disease of the biliary tract and hypercholesteremia. All patients with jaundice or obstruction of the

common duct were eliminated by the exclusion of those in whom the icterus index was elevated. The studies may be summarized as follows:

1. A series of 110 medical and surgical patients with disease of the gall bladder and associated hypercholesteremia were placed on a low cholesterol diet. A control series of 35 patients did not receive this diet.

2. Of 80 medical patients 82 per cent showed an appreciable reduction in the blood cholesterol; 80 per cent were symptomatically benefited. Fifty per cent of the control group showed an inconsequential reduction of the blood cholesterol; 33 per cent were symptomatically benefited.

3. Sixty-seven per cent of the 30 surgical patients placed on the low cholesterol diet after cholecystectomy showed an average reduction in blood cholesterol of 24 per cent; 79 per cent were symptomatically benefited. In the control group 65 per cent of the patients showed an average reduction in blood cholesterol of 5 per cent, and 64 per cent showed symptomatic benefit.

4. Among the surgical patients who had symptoms after cholecystectomy and were treated with the low cholesterol diet, 10 per cent of those showing a reduction in blood cholesterol were not benefited. In the control group 40 per cent were not benefited.

5. Minimum readings of the blood cholesterol were obtained within the first eight months for 93 per cent of the medical patients on the low cholesterol diet; whereas after cholecystectomy minimum figures were obtained only after eight months for 50 per cent of the patients.

6. Twelve patients with gall-bladder disease and a normal value for blood cholesterol pre-operatively had hypercholesteremia after cholecystectomy.

The authors concluded that:

1. The low cholesterol diet has been found by repeated chemical analyses to reduce the blood cholesterol in cases of hypercholesteremia.

2. The low cholesterol diet gives symptomatic relief in most of these cases.

3. The diet is indicated after cholecystectomy, to preclude hypercholesteremia and recurrent symptoms.

ARTHUR S. W. TOUROFF, M.D.

Manson, M. H., and Eginton, C. T.: The Cause of Death in Bile Peritonitis. *Surgery*, 1938, 4: 392.

Although bile peritonitis is relatively uncommon, it is a complication which accounts for a significant number of deaths following operations upon the biliary tract. The mortality is usually given as about 50 per cent. Controversial opinions have been expressed as to the cause of death in these cases. Some believe that if the bile is sterile it is innocuous. Others believe that even if the bile is sterile it may cause death as the result of the toxicity of its components, especially the bile salts. A third theory is that death is due to endogenous infection, especially by clostridium welchii. Finally, shock from associated fluid loss has been designated by some as the chief lethal factor.

In order to demonstrate the noxiousness of intraperitoneal sterile bile and, more specifically, to determine the cause of death in choleperitoneum, several series of animals were subjected to experimental procedures. The results of the experiments may be summarized as follows:

The intramuscular injection of bile salts produces toxemia and even death, toxicity being directly proportional to the dose of the drug.

Bile injected into the peritoneal cavity possesses some specific toxic or devitalizing action apparently not dependent upon contained micro-organisms. Bile escaping into the peritoneal cavity from the gall bladder or extrahepatic biliary-duct system possesses the same characteristics. This specific toxic action is quantitative and appears to be due to the content of bile salt in the bile.

The remainder of the experimental work consisted in repetition of the experiments of Harkins, Harmon, Hudson, and Andrews, who contended that death in choleperitoneum was due to shock from loss of plasma-like fluid into the peritoneal cavity, and also an attempt to find effective treatment for the condition in experimental animals.

One hundred and forty c.cm. of sterile bovine bile containing 170 mgm. of bile salt per cubic centimeter were injected intraperitoneally into 2 dogs. Blood-pressure tracings revealed an initial slight drop in the blood pressure, then a more gradual profound drop, and a final slow drop until death occurred four hours after the injection. During this period the hemoglobin rose to 120 per cent. At autopsy 250 c.cm. of darkly hemorrhagic fluid were found in the peritoneal cavity. In other experiments bile was permitted to flow into the peritoneal cavity from the gall bladder, and in still others bile salts were injected intravenously. The typical fall in the blood pressure ending in death occurred in all of these experimental animals. In the dogs having ascites from intraperitoneal bile irritation, there was a consistent elevation of the hemoglobin percentage due to hemoconcentration from loss of fluid. In the opinion of the authors, the loss of fluid into the peritoneal cavity was not sufficient in itself to cause death, but was an important contributing factor. A six per cent acacia solution administered intravenously prevented or delayed death in a sufficient number of animals to re-emphasize the fact that shock due to fluid loss was a factor in the causation of death from bile peritonitis. It also demonstrated that intravenously administered isotonic colloid solutions constituted a valuable therapeutic agent in this condition.

ARTHUR S. W. TOUROFF, M.D.

Salici, L.: Modifications of the Amino-Acid Curve in the Blood After the Complete Abstraction of Bile (Modificazioni nella curva ammino-acidemica dopo derivazione completa della bile). *Arch. ital. d. mal. dell'appar. digerente*, 1938, 7: 334.

The author conducted a series of experiments with the purpose of studying the alterations in the deamin-

izing power of the liver following the total abstraction of bile. He used dogs as experimental animals. Following laparotomy, the common duct was isolated and a biliary fistula was produced, through which the bile was draining freely.

The deaminizing power of the liver was studied by determining the amino-acid level in the blood. The dogs were kept in a fasting state for about twelve hours, after which time 7 c.cm. of blood were withdrawn. Immediately afterward 5 c.cm. of a 12 per cent solution of pure glycocoll were injected intravenously and the amino-acid level in the blood was redetermined fifteen, thirty, and sixty minutes following the injection. The amino-acid nitrogen was determined according to Van Slyke's method. Subsequently the animals were operated upon and a biliary fistula was produced. The experiment was then repeated in the same order as outlined.

Salici found that fifteen minutes after the intravenous injection of glycocoll into the normal fasting dog the amino-acid level in the blood was decreased. The amino-acid curve of the blood then began to rise gradually without, however, reaching the initial values. It was believed that this phenomenon was due to a sudden increase of the molecular concentration of the blood, which was counteracted partly by the deaminizing power of the liver and partly by the absorption of glycocoll by the muscles, which simultaneously released water into the blood.

In dogs with a biliary fistula, however, the amino-acid curve did not show a fall following the injection of glycocoll; on the contrary, it had a tendency to rise. This rise persisted and became even more pronounced one hour after the injection of glycocoll. One month following surgical intervention the amino-acid value of the blood showed irregular variations and had a tendency to be high.

This proves conclusively that the complete abstraction of bile definitely decreases the deaminizing power of the liver, probably because of direct injury to the liver cells. As the result of this disturbance the detoxifying power of the liver is seriously impaired and death results if this function of the liver is completely abolished. RICHARD E. SOMMA, M.D.

Baxter, H., Baxter, S. G., and McIntosh, J. F.: Variations in the Level of Serum Lipase in Experimental Pancreatitis. *Am. J. Digest. Dis.*, 1938, 5: 423.

Ligation of the pancreatic ducts, division of the pancreas between ligatures, and excision of the body of the pancreas are associated with the appearance of an olive-oil-splitting lipase in large amounts in the blood stream. The serum esterase, however, remains unaltered. Cherry and Crandall believe this to be evidence of the specificity of pancreatic lipase. The authors' experiments on dogs were done to determine the variation in serum lipase in the presence of experimental pancreatitis. Following the injection of bile into the major pancreatic duct there was a prompt rise in the serum lipase which usually reached a maximum in from twenty-four to forty-eight hours. After reaching the peak it subsided abruptly at first, and then more gradually until an approximately normal level was reached within from seven to ten days. The changes found at autopsy varied from a typical acute hemorrhagic pancreatitis with necrosis to a reaction so slight that eleven days after an injection of bile into the duct of Wirsung the only changes noted in the pancreas were focal areas of fibrosis and round-cell infiltration. In 2 dogs that showed a high level of blood lipase following operation, no significant changes were found in the pancreas at necropsy. An increase in the serum lipase occurs regularly in experimental pancreatitis and its estimation should prove valuable to the surgeon in diagnosing cases which show signs and symptoms suggestive of acute or subacute pancreatitis.

MANUEL E. LICHTENSTEIN, M.D.

Fraser, Sir J.: The Surgical Treatment of Obstructive Jaundice in Pancreatic Disease. *Brit. J. Surg.*, 1938, 26: 393.

One thousand and thirty-five cases of obstructive jaundice following pancreatic disease form the basis of this review. All the cases under consideration represent obstructive jaundice secondary to chronic pancreatic disease.

The condition is more common in males than in females, in the proportion of 2 to 1. The age of the patients ranged from thirty-four to eighty-two years, the largest number being between fifty-five and sixty-five years. This peak age incidence is common to both simple and malignant conditions.

Even at operation, it may be difficult to establish the true nature of the morbid condition. Seven per cent of simple cases are mistakenly diagnosed as malignant, while 16 per cent of the malignant cases are classified as simple.

The degree of jaundice may offer a clue to the diagnosis of the malignant case. The malignant type of pancreatic disease is the one which is associated with the more severe degrees of jaundice. An immediate direct Van den Bergh reaction is an infallible indication of the obstructive nature of the jaundice.

The pancreatic source of the obstruction may be established by: (1) the sequence of the case history; (2) the character of the pain; and (3) the state of the gall bladder. In malignant disease nausea, anorexia, an early loss of weight, and the appearance of cachexia are always present and always precede the development of the jaundice. If the lesion is simple, however, jaundice is usually the first significant symptom. Pain was recorded in 54 per cent of the cases. In 12 per cent colic of a biliary type was present, although no gall stones were found to exist. It is important to note that morphine did not relieve this colic, but rather tended to aggravate it. Apart from the jaundice and the characteristic general appearance of the patient, distention of the gall bladder is an almost constant finding in malignant pancreatic disease.

X-ray investigation after a barium meal is of little or no value.

A knowledge of the degree of obstruction is afforded by the icteric index and serum bilirubin readings. The results of these tests aid in the prediction of the prognosis. The icteric index figures ranged from 18 to 262, and a reading above 150 was considered ominous. The serum bilirubin readings ranged from 2.5 to 14.6 mgm. per cent, and it was agreed that any figure in excess of 5 mgm. per cent was associated with definitely increased risks.

An estimate of the extent, site, and nature of the pancreatic disease may be reached by examination of the fat content of the stool. In pancreatic insufficiency the total fat of the stool is increased up to 70 or 80 per cent; the increase is found to be in the neutral fats and is the result of defective fat splitting. In pure obstructive jaundice, which does not imply interference with the external secretion of the pancreas, the total of fat is also increased but the increase is in the fatty-acid fraction, since the fat-splitting action is normal.

Sugar tolerance and blood-urea readings offer reliable information regarding the effects of the obstruction on the liver and renal functions. Since the essential lethality of the condition of obstructive jaundice is related to a sequence of events which culminates in one or the other of two disasters—liver or renal dysfunction—these tests are of great value.

Blood-coagulation readings yield uncertain results, and are of doubtful value.

There is a diversity of opinion as to the advisability of operation for obstructive jaundice arising from pancreatic disease, but the overwhelming majority of workers favors operation. Of the various types of operation, internal drainage or an anastomosis procedure is most favored, and cholecystogastrostomy is the choice in 45 per cent of the cases. The operative mortality figures are: (1) for all classes of cases, 40.1 per cent; (2) in malignant disease of the pancreas, 51.84 per cent; and (3) in chronic pancreatitis 19.8 per cent. There is an association between the grade of jaundice and the mortality rate. Cholemia is given as the most common cause of death. This clinical syndrome is recognized as the development associated with the fatal issue in the greatest number of cases. In it there are present a rising temperature, vomiting, loss of consciousness, and anuria. Its effects are exerted about the fifth day, and its development appears to be related to the sudden decompression of the biliary system. If some method could be evolved which gave more gradual relief of pressure the immediate results might be improved.

White bile was found in 4.4 per cent of the cases, with an associated mortality of 82.5 per cent. Whether it is an evidence of sepsis and the result of a removal of bile pigment by leucocytes, or whether it is an evidence of hepatic suppression, it is, in a clinical sense, a most ominous sign.

A study of the survival period following operation for malignant disease of the pancreas shows that 90 per cent of the patients die within the first year, but during life a large percentage enjoy freedom from pain, jaundice, and pruritus.

A similar analysis in chronic pancreatitis shows that 60 per cent of the patients are alive at varying periods exceeding one year after operation, and are enjoying relatively good health. When relapses occur they are apt to be associated with previous operations of the surface-drainage type.

The review of these cases seems to offer two suggestions: (1) operation should be performed early before liver and kidney function is seriously impaired; and (2) in cases of severe jaundice, a two-stage method should be used for the purpose of diminishing the risks of sudden biliary decompression.

SAMUEL KAHN, M.D.

MISCELLANEOUS

Schockaert, J. A., Rosman, J. P., and Nolens, H.: The Sedimentation Rate as a Diagnostic Aid in the Differential Diagnosis of Acute Adnexal Diseases, Appendicitis, and Extra-Uterine Pregnancy (La sédimentation globulaire comme élément de diagnostic différentiel dans les annexites aiguës, les appendicites et la grossesse extra-utérine). *Bruxelles-méd.*, 1938, 18: 1334.

The authors are strongly convinced of the value of the determination of the sedimentation rate of the blood in the differential diagnosis of certain gynecological syndromes which may be easily confused. They point out that in acute adnexal disease, various types of appendicitis, and extra-uterine pregnancy and its complications the temperature and pulse findings often follow no standard, that the leucocyte count may be deceiving, being either inordinately high or comfortingly low, and that even the best history and physical examination may only further the clinician's perplexity.

With a review of their own and other cases, they show that in acute adnexal infections the speed of the sedimentation is greatly accelerated in a large majority of cases, and that in acute appendicitis it is also raised, but the rate is not nearly so high. In 95 per cent of all cases the sedimentation rate makes possible a differential diagnosis between these two disease entities; this is important for the patient, of course, since the treatment of the former is nonsurgical, and of the latter, always surgical. These workers found the average sedimentation rate in acute adnexal disease to be 50.1 mm. after one hour and 81.4 mm. after two hours, while for appendicitis it averaged in all cases well under 20 mm. for the first hour, and over 50 mm. only once in 101 cases. They recommend, therefore, that if the sedimentation has proceeded past 20 mm. during the first hour, surgery may be safely shelved, at least temporarily, and the patient should be put to bed and treated for adnexal disease.

In tubal pregnancies the sedimentation rate varies considerably, according to whether the lesion is a simple tubal pregnancy, an encysted hematocele, or an actual hemoperitoneum. In 12 cases of verified encysted hematocele the average sedimentation rate was 18.8 mm. after the first hour and 41.6 mm. after the second hour, which allows a margin of some

diagnostic value when matched with the findings of acute appendicitis.

The authors, admit, however, that the differential diagnosis between acute adnexal infections and the presence of free blood in the pelvic cavity, as after the rupture of a tubal pregnancy, is not made possible by a study of the sedimentation rate. Diagnosis then must depend on the history and manual examination. JOHN MARTIN, M.D.

Moncalvi, L.: The Syndrome of Abdominothoracic Lesions and Its Importance for Emergency Surgery (Interferenze, sindromi ed affezioni addomino-toraciche nella chirurgia d'urgenza). *Arch. ital. di chir.*, 1938, 49: 1.

The knowledge of the abdominothoracic syndrome is of great importance for every surgeon because many pathological conditions of the thoracic organs may simulate surgical diseases of the abdomen and *vice versa*. Either the pathological process may spread by contiguity, or certain reflexes may be responsible for the confusion because numerous anastomoses between the cerebrospinal and the sympathetic system offer infinite possibilities of various combinations of symptoms.

Traumas may involve the thorax and the abdomen, causing on the one hand an "emoftoe," subcutaneous emphysema, hemopneumothorax, and hemopericardium, and on the other hand pains in the abdomen, hemoperitoneum, pneumoperitoneum, and hematuria. An exploratory laparotomy should be followed by an aspiration of the hemothorax.

A congenital or acquired spontaneous or traumatic hernia may produce dyspnea, borborygmi, abnormal percussion sounds over the thorax, abdominal pains, digestive disturbances, and vomiting. A roentgenographic examination after an opaque meal or pneumoperitoneum is essential.

A subphrenic abscess may produce intercostal pains, dyspnea, an abnormal distention of one-half of the chest, and dullness on percussion, as well as vomiting, meteorism, and descent of the lower hepatic border.

In addition to the well known abdominal symptoms, such as pain in the epigastrium and tympanites, a perforation of a gastric or duodenal ulcer may cause thoracic signs, viz.: cyanosis, tachycardia, dyspnea, and limitation of respiratory movements.

Inflammation of a subhepatic or retrocolic appendix may produce, in addition to pains in the right upper quadrant of the abdomen, pains in the chest, limitation of the respiratory movements, and dullness over the base of the right lung. A concomitant pneumonic focus, a bronchopleural involvement, or a valvular endocarditis in the course of a peritonitis should not be overlooked. Vague abdominal pains combined with right, left, or bilateral serous pleurisy or pericarditis suggest polyserositis, for which pericardiolysis or cardio-omentopexy may be considered.

Among chest conditions responsible for an abdominal symptomatology, pneumonia and basal, diaphragmatic, or mediastinal pleurisy must be mentioned: in addition to the typical signs they may cause acute pains in the epigastrium or hypochondrium and vomiting, thus simulating an appendicitis. Furthermore, angina pectoris, caused by an aortitis or a coronary sclerosis, may lead to an arrhythmia, precordial pain, bradycardia, and typical angina attacks, as well as to digestive disturbances and abdominal pains.

An infarct of the myocardium or a rupture of the aorta within the endopericardium is known to have caused precordial pain, arrhythmia, tachycardia, dyspnea, and cyanosis in addition to sharp epigastric pains, vomiting, and other abdominal symptoms.

JOSEPH K. NARAT, M.D.

GYNECOLOGY

UTERUS

Delmas, P.: The Uterus Considered as One of the Cavities of the Organism (De l'utérus considéré comme une des cavités de l'organisme). *Rev. franç. de gynéc. et d'obst.*, 1938, 33: 513.

Delmas notes that in the adult animal organism there are multiple cavities, which originate by two methods. Cavities of the first group are formed by fission; these include the serous cavities and the more highly differentiated circulatory organs. Cavities of the second group are formed by invagination, as all the organs of this type originate in a small depression between the layers of the primitive embryo. To this group belong the digestive organs and the uterus. In the female embryo, the wolffian duct atrophies and the two Mueller's ducts originate from it. The two ducts remain separate in their upper portion to form the fallopian tubes, but unite in the lower portion to form the uterus and the vagina.

The essential structure of the uterus, resulting from this embryological development, consists in the epithelial lining and the muscular wall; the latter has two layers: the external layer is a continuation of the longitudinal fibers of the fallopian tubes, the internal layer a continuation of the circular fibers. The external serous covering results from the presence of the uterus in the peritoneal cavity.

The uterine cavity is triangular in shape, with the base of the triangle above. During the first three months of pregnancy, with the growth of the embryo, it becomes rounded; during the second three months the uterus is molded around the fetus, and tends to become ovoid; and during the last three months the head of the fetus turns toward the isthmus.

The mucosa of the uterus is modified for the nidation of the ovum; and during pregnancy a vascular network between the two muscular layers is much hypertrophied to insure a sufficient blood supply to the developing fetus. When the time of delivery comes, the uterus is also the "agent of expulsion"; in this the cervix plays a part on account of its muscular structure. The mucosa of the cervix, however, does not undergo any alteration during pregnancy.

ALICE M. MEYERS.

Villata, I.: Leucemic Infiltration of the Uterus (Infiltrazione leucemica dell'utero). *Riv. ital. di ginec.*, 1938, 21: 287.

Leucemic infiltration of the genital organs, and especially of the uterus, is rather rare and little known. However, this rarity is probably due to the fact that anatomicopathological search for the typical changes has not been extended to the uterus because it seldom shows macroscopic alterations. The author reports 2 cases in women aged fifty-four and eighteen years, respectively, in whom he found leucemic infiltrations of the uterus at autopsy.

In the first case, the clinical data and the blood and anatomicopathological findings did not leave any doubt as to the diagnosis of leucemic lymphadenosis. Attention was called to the morphological aspect of the uterus, the enlargement of which did not seem to be justified by the previous pregnancies nor by any inflammatory or neoplastic process. Vertical section showed that the tissues of the organ were of a homogeneous grayish-white color. Histological examination revealed numerous elements of lymphocytic type in the three coats of the uterus, but excluded the possibility of an inflammatory process, tuberculosis, myometritis, or small-cell sarcoma. The findings in the other organs (liver, spleen, lymph nodes, and bone marrow) and the diagnosis made while the patient was still alive showed that the uterine changes were leucemic lesions.

In the second case, the diagnosis of leucemic lymphadenosis was also evident, but at autopsy attention was not called to the uterus, which was found to be enlarged only after its diameters had been measured and its weight verified, and both measurements had been compared to those of the normal uterus of women of the same age. Even the color of the myometrium and its consistency were only slightly changed and did not justify the macroscopic diagnosis of leucemic infiltration. However, the author's suspicion having been aroused by the findings in the first case, he proceeded to the histological examination of this uterus and discovered that the infiltration by leucemic elements was much more pronounced than was suggested by the macroscopic aspect of the organ: not only the myometrium but also the mucosa was infiltrated.

In both cases, the infiltration was too intense to permit determination of whether it had started from the perivascular tissues. In the search for signs of leucemic infiltration of the uterus, the increase in volume, the homogeneous whitish color of the surface upon section, the slight change in consistency, and the swelling of the mucosa should be kept in mind. Undoubtedly, leucemic involvement of the uterus is more frequent than is expected in the forms of lymphadenosis or leucemic and aleucemic myelosis, and may lead eventually to functional disturbances. Whether it is more frequent in multiparas than in nulliparas remains an open question.

RICHARD KEMEL, M.D.

Miller, N. F., and Folsome, C. E.: Carcinoma of the Cervix. *Am. J. Obst. & Gynec.*, 1938, 36: 545.

A total of 1,026 patients with carcinoma have been studied; of these, 676 had carcinoma of the cervix Seventy-six per cent of the patients were treated with combined x-ray and radium therapy. Ten per cent of the patients, or those with advanced lesions, received x-ray therapy only, 11 per cent were treated

by other methods or combinations of methods, and 3 per cent received no treatment of any kind. In general, deep x-ray therapy preceded the radium application to the cervix and adjacent structures.

In 1936, 14 cases of hip fracture among patients treated in this clinic were reported. The authors have now seen a total of 35 proved fractures and many more probable fractures. Twenty-five of the proved fractures occurred in the group of patients with cervical cancer.

The five-year and six-year survival rates were practically the same, namely, 24.42 and 23.66 per cent, respectively.

The authors offer the following clinical classification of cervical cancers:

Group I. Any early proved lesion involving not more than one lip of the cervix or its equivalent.

Group II. Any proved lesion more extensive than Group I, up to complete involvement of the cervix but with no parametrial thickening.

Group III. Group II cases with questionable parametrial thickening.

Group IV. (a) All lesions with definite parametrial thickening or definite bladder, bowel, or vaginal involvement. (b) Lesions presenting a frozen pelvis, with or without remote metastasis. (c) Lesions with fistula (for statistical and classifying purposes).

In the discussion ANSPACH stated that it was his belief that the operative treatment of cervical cancer will disappear. If radium is successful occasionally in the advanced cases, why not frequently in the early ones? In his series of cases in Class I, there was a 100 per cent salvage at the end of five years.

NICHOLSON said he could not allow one statement of the authors to pass without definite criticism. This was in regard to the value of treatment of lesions of the cervix. A small proportion of early carcinomas of the cervix may be cured unknowingly by the skillful use of the cautery at a stage when, as far as can be seen, the lesion is nothing more than an erosion. Furthermore, Nicholson is still willing to consider them as tending to develop into cancer. It is a very grave mistake to say, at this period of our knowledge of cancer, that the presence of cervical erosion has no bearing upon the later incidence of carcinoma. EDWARD L. CORNELL, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

Varangot, J.: Ovarian Tumors of Brenner's Type (Les tumeurs ovariennes du type Brenner). *Gynéc. et obst.*, 1938, 38: 94.

The author collected from the literature 105 cases of Brenner's tumor, in addition to his 3. The tumors occur most frequently at the time of the menopause or following it, and are exceptional in young girls. The symptoms are created essentially by the size of the tumors which, if small, are discovered only accidentally in the course of operations performed for other reasons. When the tumors are large, they cause the customary pressure symptoms and are characterized by the absence of secretion of the estrogenic hormone. Clinically, the tumors behave like benign neoplasms, and local recurrences or metastases have never been observed. On inspection with the naked eye they have the appearance of an ovarian fibroma, suggesting a simple oophorectomy. This type of intervention is justified because the tumors are always benign. The histological examination allows the differentiation of Brenner's tumors from malignant varieties of ovarian neoplasms. Recognition of the character of the tumors is important because radiotherapy in such cases is superfluous.

According to one hypothesis Brenner's tumors derive from Walthardt's islets, which originate from the endothelium of the celom. The relative frequency of Brenner's tumors and the rarity of Walthardt's islets in the ovaries militate against this theory. Nevertheless, clusters of "paramalpighian" epithelium cells, identical with non-differentiated Walthardt's islets, exist on the surface of the tubes and the broad ligaments and represent miniature Brenner's tumors. It is surprising that a voluminous Brenner's tumor has never been found in the tubes, broad ligaments, or mesosalpinx.

Schiller advanced another theory, according to which Brenner's tumors are of a wolffian origin. An inclusion in the gonads of cells primarily belonging to the urinary system may be responsible for the formation of such tumors. JOSEPH K. NARAT, M.D.

MISCELLANEOUS

Béclère, C.: The Clinical and Physiological Basis of Functional Uterine Hemorrhages Caused by Ovarian Hormonal Dysfunction (Bases cliniques et physiologiques des hémorragies utérines fonctionnelles par trouble hormonal ovarien). *Bull. Soc. de gynéc. et d'obst. de Par.*, 1938, 27: 405.

In his clinical studies of functional uterine hemorrhage, Béclère has found that the normal menopause may cause a spontaneous cure of uterine hemorrhage that has persisted for many years, a fact which indicates a close relationship between abnormal functional bleeding and normal menstrual bleeding. Premenopausal uterine hemorrhages show three distinctive characteristics in two-thirds of the cases: (1) sudden derangement of the normal menstrual periods in a woman who has previously menstruated normally; (2) complete disappearance of the normal menstrual bleeding, which is replaced by irregular menometrorrhagia, but with a free interval of from one to three weeks between these abnormal hemorrhages; and, finally, (3) a phase of amenorrhea alternating with phases of bleeding. The fact that there are periods of amenorrhea indicates that there is a disturbance of ovarian function; no purely uterine lesion causes amenorrhea. In 10 per cent of the cases there is only menorrhagia with a normal periodicity. In another 10 per cent of the cases there is only a polymenorrhea, the menstrual cycle being suddenly altered and shortened.

There are also intermediary stages between the normal menopause and abnormal functional hemorrhage before the menopause: the menopause may occur in stages with phases of amenorrhea alternating with normal menstrual periods. It may also occur by derangement of the menstrual cycle and loss of the normal rhythm, but with a normal duration and amount of flow at the menstrual period. All these facts indicate the close relation between normal menstruation and abnormal uterine bleeding of the functional type.

Clinically it has been demonstrated that surgical removal of the ovaries or suppression of the functional activity of the ovaries by roentgen-ray irradiation is sufficient to cause cessation of both the abnormal hemorrhages and the normal menstrual periods, if the abnormal bleeding is functional. In such cases no intra-uterine treatment is necessary to control the bleeding. Histological examination of the ovary in practically every case of functional uterine bleeding shows persistent cystic follicles and no corpus luteum. The uterine mucosa shows benign glandular hyperplasia in the majority of cases. Hysterography shows abnormal notching of the uterine outline, caused by abnormal hypertrophy of the mucosa from disturbed ovarian function.

In some cases Zondek has shown an excess of folliculin in the blood and in the urine of women with functional hemorrhages. Experimentally, Kaufmann has produced a benign glandular hyperplasia of the uterine mucosa in castrated women by the administration of large doses of folliculin. All these findings indicate that the glandular hyperplasia and functional hemorrhage are due to abnormal exaggeration of a normal phase of the menstrual cycle caused by increased stimulation by the persistent cystic follicles.

When one ovary or all but a small portion of both ovaries is removed in very young animals, symptoms do not develop at once, but only when the animal reaches the age of puberty. If this same operation is done in an adult animal symptoms develop at once. In analyzing these experimental results, Lipschuetz concludes that when only a small amount of normal ovarian tissue is left *in situ* it is not sufficient to inhibit the hormones of the anterior lobe of the pituitary gland, and the excessive secretion results in the formation of cystic follicles and the derangement of the normal balance between the follicular and corpus-luteum hormones.

In women with functional uterine hemorrhage the ovaries have been injured by congenital lesions or by acquired lesions due to the approach of the menopause. This injury results in excess functional activity of the anterior lobe of the pituitary gland, the formation of persistent cystic follicles, and the absence or degeneration of the corpus luteum.

These experimental findings have been confirmed in several of the author's cases. In cases in which one ovary was removed because of infection, functional uterine hemorrhages developed within a few months or later in women who previously menstruated normally. In some of these cases hysterography showed the characteristic notched appearance; in others, subsequent operation showed cystic follicles in the remaining ovary.

In women the best method of inhibiting excessive secretion of the anterior lobe of the pituitary gland without stimulation of the ovary is the injection of the male hormone. The author has recently used testosterone propionate in his cases of functional uterine hemorrhage; he has not yet treated a sufficient number of cases for statistical analysis, but his results have been encouraging.

In the discussion, Béclère stated that in all his cases of uterine hemorrhage, biopsy studies are made of the material obtained by curettage; repeated studies are made whenever possible. At the Saint Antoine Hospital, Paris, more than 300 cases of uterine hemorrhage in women of all ages have been studied both by hysterosalpingography and by curettage and biopsy. In all cases in which the uterine image was abnormal, a curettage for biopsy was done. Béclère thus has a large number of records on which his study of functional uterine hemorrhage is based.

ALICE M. MEYERS.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Dieckmann, W. J., Michel, H. L., and Woodruff, P. W.: The Cold Pressor Test in Pregnancy. *Am. J. Obst. & Gynec.*, 1938, 36: 408.

The cold pressor test was used in 152 normal pregnant women.

An increase in the systolic pressure of 30 mm. or more was considered abnormal.

Ninety patients were hyperreactors, 15 developed toxemia, and an additional 13 had transient abnormal vascular renal signs.

Sixty-two patients gave a normal response to the test. Only 2 developed toxemia, and an additional 5 had transient signs.

The cold pressor test was then compared with the pituitrin test. The abnormal reaction of the former in a pregnant woman seemed to indicate that she might develop a toxemia in which hypertension would be the predominant finding. An abnormal pituitrin reaction commonly occurred in patients with toxemia of the pre-eclamptic type.

Repeated ice-water tests, which were made on the same day in 5 patients, precipitated alarming vascular renal symptoms and signs.

EDWARD L. CORNELL, M.D.

Cotte, G., and Magnin, P.: Pregnancies Following Myomectomies (Les grossesses consécutives aux myomectomies). *Gynéc. et. obst.*, 1938, 38: 5.

Wishing to determine the number of pregnancies that have occurred in their myomectomized patients during the past ten years, the authors sent a questionnaire to those who had not yet reached the age of forty-one years at the time of the intervention. They received an adequate answer from 59, but 26 of these had to be eliminated because for various reasons the possibility of pregnancy was out of the question in their cases. Of the 33 remaining women, whose genital organs could be considered normal, 10, or 30 per cent, had had one or more pregnancies: 2 of these had aborted and 8 had gone to term without incident. Five had had 1 pregnancy, 2 had had 2, and 1 had had 3 pregnancies. There was no marked difference as to the location and volume of the myomas between the women who became pregnant after myomectomy and those who did not become pregnant, but the pregnancies were much more frequent in women who had not yet reached the age of thirty-five years. As in half of the cases an interval of at least two years had elapsed between the intervention and the pregnancy, the percentage of women who had had pregnancies would rise to 40 if the necessary correction were made. There is also the problem of voluntary sterility.

From the point of view of future pregnancy, the absolute necessity of complete covering of the myomectomized pocket when in the vicinity of the uterine horns should be remembered, while angulation or obliteration of the interstitial portion of the tube must be avoided.

Two of the patients who had been married several years became pregnant for the first time after myomectomy; unfortunately, 1 aborted. On the other hand, 8 married women, whose adnexa appeared to be normal, remained sterile. Consequently, it would seem that the presence of myomas in a sterile woman cannot be regarded *a priori* as the cause of this sterility. Among 7 women who went to term, 3 had had only miscarriages before the intervention: in these cases it is allowable to suppose that the myomas were the cause of the interruption of the previous pregnancies. However, it would be wise after myomectomy to institute such specific or hormonal treatment as might be indicated by laboratory or clinical findings in these cases. The bogey of dystocia after myomectomy should be dispelled because pregnancy and delivery take place in the normal manner after this intervention.

The statistics of Nystrom and of Gouilloud, as well as those of Haupt and of Hamant, on pregnancy after myomectomy show that the figures given in the global statistics of Massabuau and Guibal (6 per cent) and of Boehler (10 per cent) tend to give a wrong impression: only cases in which pregnancy is possible should be used to establish the percentages, while single women, those too old to become pregnant, and those having adnexal lesions should be excluded. This will give a minimum of one-third of the patients, who are apt to have one or more pregnancies. With all the other advantages offered by myomectomy, it must be admitted that this intervention is the treatment of choice in case of myoma and that hysterectomy should be considered only when conservation is absolutely impossible.

RICHARD KEMEL, M.D.

Fitzgerald, J. E., and Webster, A.: Hyperemesis Gravidarum. *Am. J. Obst. & Gynec.*, 1938, 36: 460.

Consideration of a large number of cases of hyperemesis gravidarum reveals that they may be placed in two groups for prognostic study. Patients in the first group improve readily, often with no treatment except that of rest and isolation, and the life of the patient is never in danger. Those in the second and smaller group respond slowly to treatment, and a few of them die. A study of the fatal cases in this series indicates that a certain number of deaths might have been prevented, and that in the future such deaths may be prevented by close attention to the following general principles:

1. So-called cured patients should be kept under close observation.

2. The lack of clinical improvement, regardless of laboratory findings, should be regarded as an unfavorable prognostic factor.

3. Apparent clinical improvement, such as cessation of the vomiting and ability to retain food, in the presence of persistent tachycardia, elevated temperature, and persistent urinary abnormalities, should not be considered as a sign of the patient's improvement. In 6 of the 15 fatal cases, it was shown that the patients had retained food for some time before death.

4. Listlessness, stupor, involuntary urination and defecation, and periods of irrationality are frequently evidence that the toxemia will result fatally, whatever the treatment.

5. Cervical packs and bags should not be used in cases in which therapeutic abortion is to be done. If the cervix is not easily dilatable, vaginal hysterotomy should be performed, so that the uterus may be emptied promptly.

There were 32 therapeutic abortions in this series of 396 cases of hyperemesis. Death occurred in 15 cases. Color, age, parity, and the marital state seem to have no influence on the course of the disease. Persistent tachycardia, fever, diacetic acid, and acetone are danger signals. The ability of patients who are seriously ill to retain food and fluids is not necessarily a sign of improvement.

The majority of the patients in this group responded promptly to rest, diet, glucose therapy, and fluids. Abortion should be done in the cases of those who fail to respond to adequate treatment in a reasonable length of time. Therapeutic abortions delayed too long are not life-saving measures.

Death from hyperemesis is avoidable.

EDWARD L. CORNELL, M.D.

Holtz, F.: The Treatment of Abortion (Le traitement de l'avortement). *Acta obst. et gynec. Scand.*, 1938, 18: 245.

Holtz reports a study of the results of different methods of treatment of abortion as carried out in three obstetrical clinics in Stockholm, Sweden. He distinguishes abortions in the first three months from abortions or premature births in from the fourth to the seventh months; there were 1,583 cases in the first group and 1,135 cases in the second group. In abortions in the first three months active treatment consisted in the prompt emptying of the uterus by means of Saenger's forceps and curettage. In 374 febrile cases without severe hemorrhage treated by this method there were no deaths, and extension of the infection occurred in only 6 cases or 1.6 per cent. In 215 non-febrile cases treated actively there was extension of the infection in only 1 case or 0.5 per cent. In 366 febrile cases treated conservatively (without curettage) there were 4 deaths, and 33 cases (9 per cent) with extension of the infection; in 198 non-febrile cases treated conservatively there were no deaths, but extension of the infection occurred in 3 cases (1.5 per cent) and endometritis in 7 cases (3.5 per cent). In 82 cases curettage was done after prolonged conservative treatment; in these cases there were 2 deaths (2.4 per cent) and 4 cases with extension of the infection (4.9 per cent). Secondary anemia occurred more frequently in the cases treated conservatively than in those treated actively—in 2.2 per cent of the febrile cases and in 2.6 per cent of the non-febrile cases treated conservatively, and in only 2 or 0.5 per cent of the febrile cases treated actively and in none of the non-febrile cases treated actively. Active treatment (curettage) evidently gives definitely better results than conservative treatment in abortion in the first three months not complicated by severe hemorrhage. In cases with hemorrhage, curettage does not give quite as good results, for in 122 febrile cases with hemorrhage there was 1 death (0.8 per cent) and extension of the infection in 2 cases (1.6 per cent), and in 66 non-febrile cases, there was extension of the infection in 3 or 4.5 per cent, but no deaths. The incidence of secondary anemia is much higher in cases with hemorrhage, as would be expected; in this series it occurred in 22.1 per cent of the febrile and 28.8 per cent of the non-febrile cases. However, in the presence of severe hemorrhage, curettage is necessary to prevent further bleeding.

In a follow-up study of patients at least four years after the abortion, it was found that conservative treatment was followed by sterility more frequently than active treatment, and that tubal pregnancy also occurred more often after conservative treatment. Active treatment therefore gives definitely better results in non-complicated cases of abortion in the first three months than conservative treatment.

In most of the cases of abortion in the later months, both the fetus and the placenta were expelled spontaneously with or without the aid of oxytocics. It is only in cases with retention of the placenta that the question of the need for intervention arises. In non-febrile cases there were no deaths and no extension of the infection with either conservative or active treatment; with conservative treatment, however, 8.3 per cent of the patients developed endometritis and 11.1 per cent, secondary anemia; while neither of these complications developed in non-febrile cases treated actively. In febrile cases, the mortality was essentially the same in the cases treated conservatively and in those treated actively (1 death in 60 and 61 cases, respectively); but endometritis, extension of the infection, and secondary anemia occurred with greater frequency in the cases treated conservatively. The period of hospitalization was also longer in the latter group than in those treated actively. In the follow-up of patients four years or more after abortion in the later months of pregnancy, it was found that active treatment in cases of retention of the placenta gave equally good late results as conservative treatment in cases without retention of the placenta.

In cases in which the infection has already extended beyond the uterus when the patient is first seen, when such complications as salpingitis, peritonitis, or septicemia are present, there is general agreement that conservative treatment is indicated.

ALICE M. MEYERS.

LABOR AND ITS COMPLICATIONS

Mohler, R. W.: The Management of Breech Deliveries. *Am. J. Obst. & Gynec.*, 1938, 36: 400.

This article is based on 709 consecutive breech deliveries at the Philadelphia Lying-in Pennsylvania Hospital which occurred after certain obstetrical policies, based on an analysis of 170 breech deliveries, were formulated.

The author points out the following:

X-ray examination should be made late in the prenatal period to determine the relative size of the fetus and the pelvis.

It is safer for the child, if larger than average size and in breech presentation, if it be delivered by cesarean section.

All infants in breech presentation delivered via the vagina should be extracted under light anesthesia after the breech has been delivered, and this extraction should never be undertaken by anyone who has not been adequately trained under supervision in the management of breech deliveries.

All decomposition of infants in breech presentation should be accomplished under deep surgical anesthesia after the cervix is completely dilated.

Aftercoming-head forceps should always be used after the head has become engaged.

Of 58 cesarean sections, 40 were done because of fetopelvic disproportion with a breech presentation, and the 18 others were done because of some accident of pregnancy in addition to a breech presentation. Among the 8 babies who died, there was 1 with a large breech which was the sole indication for the type of delivery chosen. The 7 other babies died because of other accidents of pregnancy, such as placenta previa and premature separation of the placenta.

In the discussion SCHUMANN states that he is firmly convinced that in the greater number of cases the cause of breech presentation is purely accidental. He believes that external version should not be practiced routinely.

VAUX also does not believe in external version. If the delivery of the child in breech presentation is progressing normally, it is his practice to leave it alone, and use analgesia, sedation, and anesthesia when necessary, until the navel of the child appears. Extraction of an impacted breech, however, is a different consideration and is attempted and performed only under deep surgical anesthesia.

NICHOLSON is certain that the mortality that has been reported in breech delivery has been in most instances the result of undue interference. Cesarean section has a definite indication in certain cases of breech presentation, particularly in the presence of moderate pelvic contractions, or in old primiparas in whom the probability of another child may be remote.

ULRICH states that waiting is a good policy, but wonders how long one should wait. The criterion for interference should be the cessation of progress. The baby will very soon show the results of this. Aftercoming-head forceps should never be employed until the head is engaged.

MUHLENBERG states that there has been a great reduction of the fetal mortality since he has routinely used aftercoming-head forceps instead of producing great pressure on the head from above.

EDWARD L. CORNELL, M.D.

PUERPERIUM AND ITS COMPLICATIONS

Johnstone, R. W.: The Prevention and Control of Puerperal Sepsis. *Brit. M. J.*, 1938, 2: 331.

There is no question that conditions in regard to puerperal infection have improved considerably during the present generation, but we are far from having reached the irreducible minimum in its incidence. What we have achieved is a fairly complete understanding of its causes. We know something about the conditions upon which the patient's resistance depends, and that toxemia, hemorrhage, exhaustion, and malnutrition decrease it. We know that trauma and hemorrhage diminish the local resistance of the tissues; we know the common sources of the most dangerous organisms, and we have learned a good deal regarding the methods of preventing their access.

There are two types of infecting organism. First, the organisms commonly found in the skin of and around the vulva, on the hands and clothes, and on unsterilized dressings and instruments—for the most part anaerobic and non-hemolytic streptococci, staphylococci, and coliform organisms. These organisms most commonly give rise to infection after labors in which there has been considerable injury of the tissues. They cause a true wound infection, and our methods to combat them are essentially the same as those adopted in surgery. Secondly, there is the hemolytic streptococcus associated with scarlet fever and erysipelas, but most commonly with tonsillitis, nasal infections, and morbid conditions of the upper air passages generally. This organism is the cause of many puerperal infections and of the vast majority of the fatal cases. Not only is this type of infection more deadly to the individual patient, but as often as not it attacks the woman who has had a normal spontaneous delivery. Among recently delivered women it appears to have a degree of contagiousness comparable only to that of smallpox. This organism is practically never present in the birth canal before labor, but is conveyed from without, and usually by droplet or spray infection from the nose or throat of one or more of those in attendance at the delivery or during the puerperium, not including the patient herself.

In the last two years there have been 2 cases in England in which a patient who went into a small maternity hospital or home for her delivery and there contracted puerperal infection has successfully claimed damages from the hospital authorities or doctor concerned because of alleged lack of reasonable care against infection.

Apart from attention to the general health and any special indications of disease, the antenatal prevention of puerperal infection involves the treatment of septic foci in the body, for example, teeth, tonsils, and the cervix uteri.

Intranatal technique is the most important point of all, for it is during labor that the danger is at its maximum. The simple main requirements are a clean vulva, clean hands, clean dressings, clean instruments, and the prevention of their contamination during the labor.

In the early days of the puerperium similar precautions must be maintained, for there is abundant evidence that some women become infected a day or two after delivery. The main principle is the prevention of infection from the hands, nose, and throat of the nurse or others attending the patient; and to this must now be added the prevention of contagion, air-borne or otherwise, from one of the patients to the others.

The sphere of drugs in the prophylaxis of infection in the puerperium has received attention from time to time. The recent introduction of sulfanilamide preparations and their striking success in the therapeutic treatment of streptococcal infections naturally raised the question whether their administration would be correspondingly successful in prophylaxis. In our experience their administration was apparently beneficial and was seldom, if ever, associated with any harmful effects.

One last risk deserves consideration, namely, air-borne infection. A few years ago most of us would have belittled the serious suggestion of such a possibility, but recently it has been shown that the air in rooms occupied by infected patients contains multitudes of virulent organisms. This is possibly the explanation of some epidemic outbreaks of sepsis in small hospitals and maternity homes.

HARRY W. FINK, M.D.

Clivio, I.: The Surgical Treatment of Puerperal Pyemia (A proposito della cura chirurgica della piemia puerperale). *Folia demograph. gynaec.*, 1938, 35: 251.

A review of the German literature, which contains the largest number of cases of puerperal pyemia reported, and the scarcity of Italian works on the subject show that this form of pyemia is rare and that its treatment is not standardized and is still a subject for discussion. The author himself has seldom encountered the pure form of puerperal pyemia during his forty-seven years of extensive obstetrical practice. The small number of Italian observations may be explained by the following reasons: (1) a difference in the manner of evaluation of the various forms of puerperal infections, (2) the difference between the large number of septic abortions included in the German statistics and the small number found in Italy, and (3) the difficulty of differentiation of purulent pelvic phlebitis of rapid course from other forms of sepsis, although this difficulty would present itself to all observers. The explanation of the difference undoubtedly lies in the first two reasons.

In a reported case of puerperal pyemia occurring in a woman aged thirty-six years, the infectious process started in the lower part of the uterus, and not in the zone of insertion of the placenta, and was propagated from there to the utero-ovarian venous plexus: this was proved by the histological findings, by the history of previous unsuccessful attempts at extraction by means of the forceps, and by the late occurrence of the symptoms of pyemia. This case suggested further consideration of this form of the disease.

The term puerperal pyemia applies to an infection which, having invaded the blood stream, has caused a form of endophlebitis with thrombus formation in one or more veins and suppuration of the thrombus, which periodically discharges infecting material into the blood stream. Evidently, this pyemia can be caused only by bacteria of low virulence, as otherwise the symptoms would be totally different. Consequently, real pyemia is in theory a chronic process and must be rather rare because various conditions must concur to keep it for a relatively long time within its stated limits. For obvious reasons, puerperal pyemia rarely occurs in clinics and in maternity institutes; practically all cases originate in women who have been infected at home before admission to a clinic. This finding naturally also applies to pyemia following criminal abortion.

In true pyemia, the treatment may change from medical to surgical when the presence of hard, somewhat painful cords, located in the base of the broad ligament or in the vicinity of the tubes, indicates the seat of the thrombophlebitic process: the blood findings in connection with the chills will confirm the diagnosis and indicate the opportunity for the surgical intervention. The question of early or late intervention must be decided on the merits of the case, but ligation of the veins must always be as complete as possible and be applied to the internal iliac, or to the common iliac, and the spermatic veins if it is undesirable to ligate the inferior vena cava. The most favorable route for the individual case, whether the transperitoneal or the extraperitoneal, should be selected for the intervention.

RICHARD KEMEL, M.D.

NEWBORN

Hillis, D. S., and Benensohn, S. J.: Infant Mortality at the Cook County Hospital, Among 16,000 Deliveries. *Am. J. Obst. & Gynec.*, 1938, 36: 427.

This survey covers the four-year period from 1933 to 1936 inclusive, during which time 16,242 babies were delivered, including 184 sets of twins, at the Cook County Hospital, Chicago. Of the 16,058 mothers, 10,016 attended the prenatal clinic, and 6,042 mothers were referred from other sources. There were 798 still-births and neonatal deaths, a gross mortality rate of 4.19 per cent. This figure includes all infant deaths occurring in gestations of

five months or over. In compiling the corrected infant mortality, all infants weighing less than 1,500 gm. were considered previable and these deaths were deducted. Also, cases in which syphilis and congenital malformations were the sole cause of death were deducted. Thus, 509 cases were excluded, which leaves a total of 289 deaths, or a corrected infant mortality rate of 1.78 per cent.

There was a total operative incidence of 8.6 per cent. Among the 14,861 spontaneous deliveries, there were 602 infant deaths, a gross mortality rate of 4 per cent, whereas among the 1,381 operative cases, 196 infants died, a gross infant operative mortality rate of 14 per cent.

TABLE I.—GROSS AND CORRECTED INFANT OPERATIVE MORTALITY

Operative procedure	No.	Infant deaths	Gross infant mortality in per cent	Corrected deaths	Corrected infant mortality in per cent
Low forceps	605	31	5.1	29	4.78
Midforceps	96	14	14.5	13	13.5
Cesarean section	288	44	15.2	24	8.3
Breech extraction	30	6	20.0	5	16.5
Version and extraction	108	25	23.1	12	11.6
Duhrssen's incision	17	3	17.6	3	17.6
Braxton-Hicks version	25	25	100.0	9	36.0

TABLE II.—CESAREAN-SECTION INFANT MORTALITY

Indication	No.	Gross infant mortality	Corrected infant mortality	Corrected infant mortality in per cent
Disproportion	86	4	2	2.3
Ablatio placentæ	24	16	6	25.0
Placenta previa	41	7	5	12.2
Toxemia	62	10	5	8.0
Previous cesarean sections	28	2	2	7.1
Ruptured uterus	7	3	3	42.4
Non-obstetric indications	40	2	1	2.1
Total	288	44	24	8.3

The Voorhees' bag was inserted for the induction of labor for toxemia, 126 cases; cervical dystocia, 19 cases; placenta previa, 28 cases; transverse presentation, 9 cases; ablatio placentæ, 9 cases; and prolapsed cord, 8 cases.

There were 40 infant deaths following the use of the bag. Twelve of these deaths occurred following the induction of labor for toxemia, and 16 in the cases of placenta previa in which the bag insertion was the treatment of choice. In 12 of the 40 infants who died, death was due to prolapsed cord following the expulsion of the bag with incomplete dilatation of the cervix. EDWARD L. CORNELL, M.D.

CARCINOMA OF THE PROSTATE

Collective Review

THEOPHIL P. GRAUER, M.D., Chicago, Illinois

PROSTATIC cancer is one of the most common conditions found in urological practice. Its treatment is a subject of considerable controversy among urologists and those interested in radiotherapy. The disease still remains resistant to practically all known methods which have been designed for its cure. Most modes of therapy are simply attempts to combat distressing symptoms and postpone the time of death, but always with the hope of producing a cure.

Caulk reports that 4 per cent of all deaths from cancer in the male result from carcinoma of the prostate, and of every 1,000 deaths in the male, 6 are due to it. Most of the authors agree pretty well that nearly 20 per cent of all patients suffering from prostatic conditions have cancer of the prostate; also almost universally they stress the fact that our best hopes lie in "early" diagnosis and treatment.

In this connection Keyes says that opinions may still differ as to the exact definition of "early" cancer of the prostate. The disease surely exists in the gland for an appreciable interval of time before it is palpable by rectal touch. At the early stage of the disease we are able to cure it almost as a matter of course, that is, if it is still confined to a hypertrophied portion of the gland and the patient is fortunate enough to submit to prostatectomy for relief. If the carcinoma is still so small as not to have established any extension to the remainder of the gland, it comes out with the adenoma, its presence unsuspected until revealed by pathological section.

Young advocates the exploration of suspicious nodules in the prostate by exposure through the perineum. The success of his radical operation depends to a great extent upon early diagnosis, and he advocates routine rectal examination of all male patients over forty years of age. He insists that most prostatic cancer arises in the posterior lobe where it can often be felt as a small hard nodule very early in the disease.

In contrast, Chauvin and Mosinger point out five processes concerned in the genesis of cancer of the prostate, and conclude from their histological studies that prostatic carcinoma has a "pleuricentrical" origin rather than a "monocentrical" origin. They believe that cancerous adenoma arises in lobules which are already adenomatous rather than in healthy glandular lobules. They base their impressions on the careful study of 115 hypertrophied prostates removed by suprapubic operation. In this group there were 6 (5.22 per cent) which showed malignant change.

Kolmert believes that the statistical material offered by Barringer (more than 280 cases of prostatic cancer) will not bear a critical investigation since the diagnoses in these cases were not always definitely established. In his report, 75 cases of definitely proved prostatic cancer were selected from 160 cases treated in Uppsala as carcinoma of the prostate, and the diagnoses were proved histologically, clinically, and roentgenologically if metastases were present. During the same period in which these 160 cases of cancer were treated, 759 cases of benign hypertrophy of the prostate were seen, the incidence of prostatic cancer therefore being 17.4 per cent. Kolmert distinguishes two types of cancer, the primary form which arises within the gland itself, and the degenerative form in a pre-existing adenoma.

Myers studied the tissues removed by prostatectomy and electroresection in cases of clinically benign prostatic hypertrophy and found evidence of carcinoma in 29.4 per cent. He advises a careful pathological examination of all removed prostatic tissue. He believes that prostatectomy has an advantage over transurethral resection in that it removes early malignant involvement and gives a chance for ultimate cure instead of simple relief from obstruction.

All these authors stress early diagnosis as the most favorable means of combating carcinoma of the prostate and, as an aid to this end, Ferguson describes in detail the aspiration method of obtaining biopsy material from patients suspected of having prostatic cancer. The object of this method is to differentiate neoplastic from non-neoplastic tissue; however, attempts to classify tumors or to grade them by this method will fail except in rare instances. Ferguson's figures tend to prove that the accuracy of the method improves with the experience of the surgeon, study of autopsy material, and the experience of the pathologist studying the biopsy material.

Van Bogaert, Van Cauteren, and Scherer describe a case of prostatic carcinoma with bony changes involving the spine, pelvis, ribs, and later the long bones in a male aged forty-four. The symptoms at first were pains in the extremities, later involving other parts of the body. The x-ray findings and clinical symptoms were similar to those of Paget's disease of bone. Only once during these observations were there any urinary symptoms and these were quickly relieved by urotropin.

On autopsy a very small hard carcinoma of the prostate was found, with extensive metastases to the abdominal lymph glands, the liver, lungs, and almost the entire skeleton.

These authors conclude that the general condition of the patient remains better in Paget's disease in which the cachexia of malignancy is not present. The bony changes in Paget's disease are of a more fragile type and not the ivory-like changes as in osteoblastic carcinoma. The high content of phosphorus in the blood which is found in Paget's disease is not diagnostic since their patient with prostatic carcinoma had a content of phosphorus in the blood which was from 8 to 10 times the normal.

Hager and Hoffmann in their statistical report state that the presence of metastasis is a paramount factor in the choice of treatment and in the prognosis. It is probably the deciding factor in the determination of relative cures. In their series metastasis was demonstrated by the x-rays at the initial examination in 107 cases and after the first examination in 26 instances over a period of five years. It was apparent that fully 25 per cent of the cases of prostatic malignancy had demonstrable bone metastasis at the time the diagnosis was first made.

There is great variance and considerable confusion of opinion when treatment of carcinoma of the prostate is discussed.

Young, who devised the radical perineal operation, demonstrates the types of cases in which success can be expected by this procedure in one of his papers. In his series of 33 cases he reports 17 (53 per cent) as apparently cured. Four of his patients have lived ten years postoperatively, 1 of these for twenty-two years, without signs of recurrence. He states that the radical operation is not difficult; the mortality is low. Normal micturition and complete urinary control have been obtained in many cases. In those cases in which the patients were not cured, but died later of metastasis, the local result was often good.

A German author, Schanz, reports a series of 144 cases of prostatic cancer. Of these 44 or 31 per cent were sufficiently early to warrant radical operation. He believes that if the prostatic capsule is involved in the carcinoma infiltration, the condition is too advanced for radical operation. Postoperative x-ray therapy is given routinely. Two of his patients lived more than five years after operation and 40 per cent lived more than three years. In the past four years Schanz has used permanent suprapubic fistulas only when the urethra did not permit instrumentation. In all other cases obstruction was relieved by electroresection.

Higgins and Crowell divide cases of carcinoma of the prostate into groups; (1) carcinomas which are very small and are found on microscopic examination of the removed hypertrophied prostate; (2) carcinomas which are confined to the prostate; (3) carcinomas which extend beyond the prostate but which are not associated with urinary obstruction; and (4) carcinomas which extend beyond the prostate with associated urinary obstruction.

In the first group the authors believe postoperative x-ray irradiation is of some value. If it is technically feasible, they advise radical surgery followed by roentgenotherapy. Transurethral resection should be employed to relieve urinary obstruction and in inoperable cases they believe x-ray therapy is of value in retarding the growth of the tumor, lessening pain, and reducing the bleeding.

Blumel believes that removal of the cancer, either suprapubically or by the perineal route, is the treatment of choice whenever this is possible. He believes that transurethral removal of the obstruction should be done in cases in which removal of the cancer is not feasible. His experience with deep x-ray therapy has been disappointing.

Keyes and Ferguson describe an operation for implanting radon seeds into the cancerous prostate through a cystotomy opening. The seeds are accurately spaced by implantation through a perforated plate which fits over the vesical surface of the prostate, with the aid of an ordinary radon seed applicator. Of 14 patients operated upon more than three years ago, 2 developed urethrorectal fistulas. In 2 patients the bladder failed to close. Of these 14 patients, 4 are still alive without evidence of active cancer.

Barringer is not enthusiastic about surgical removal of the cancerous prostate because the results by and large are poor and the immediate mortality high. He believes that deep x-ray therapy alone, even by the best methods, is inadequate. He believes that external irradiation must be supplanted by some form of irradiation

within the prostate itself. The suprapubic implantation into the prostate of radon seeds is comparatively simple as far as the implantation of the lateral and subtrigonal lobes is concerned. However, if we turn to the posterior lobe, the lobe that is wholly subvesical, we appreciate how difficult any implantation of this lobe from the vesical side may be. The posterior lobe is almost always involved in the growth, and suprapubic implantation must be supplemented by perineal treatment of this lobe.

If Barringer is reasonably sure that there is no involvement of the lateral and subtrigonal lobes and the cancer is confined to the posterior lobe, then the ideal method of irradiation is through the perineum by means of radon needles which are inserted in much the same way as the instruments used for an aspiration biopsy. The tissue of the posterior lobe, the periprostatic tissue, and the perilymphatic invasion around the seminal vesicles can be easily reached by this method. This perineal irradiation must be repeated at intervals until the prostate is sclerosed. Radon seeds may be implanted perineally, but they cannot be as accurately placed as the removable needles.

A series of 158 cases of prostatic carcinoma treated chiefly by teleradium, at a distance of from 7.5 to 10 cm., given through multiple portals was reported by Burnam. A total dosage of from 100 to 300 gm. hr. was given within from two weeks to three months, the variation depending upon the condition of the patient. About 30 of these 158 cases were treated with teleradium and some other form of therapy. Burnam has observed that prostatic cancers vary greatly in their sensitivity to radiation and in their malignancy. Cross-firing with radium at a distance or with roentgen rays is the most valuable palliative method at present. In cases of obstruction not promptly relieved by irradiation, he believes electroresection is indicated, which is to be followed by more irradiation.

The English author, Nitch, states that the best results from x-ray therapy for prostatic cancer are obtained by the five-field-maximum methods of Holfelder and Reisner. The immediate results from x-ray treatment are often excellent but the ultimate results are disappointing. Nitch says radium effects are better. He has a method of radium application in which 14 mgm. of radium are used on the posterior and lateral surfaces of the prostate by means of the insertion of needles after perineal exposure of the prostate. Fifty milligrams are applied to the vesical surface of the prostate by means of a metal box and 5 mgm. are inserted into the prostatic urethra. The metal box containing the radium is enclosed in a Pilcher bag and is applied to the vesical surface of the prostate after suprapubic cystotomy, and the tube is attached to the Pilcher bag containing the 5 mgm. of radium meant for the prostatic urethra. Nitch believes the results from this procedure are better than those from any other conservative procedure.

Caulk condemns palliative suprapubic cystotomy for obstruction due to cancer as an unnecessary procedure. Suprapubic enucleation of a cancerous prostate should never be done as it hastens the progress of the disease. Conservative perineal prostatectomy is seldom advocated for this condition. Caulk, himself, uses a combination of radon-seed implantation and x-ray therapy and believes in the relief of obstruction by means of the transurethral operation when it becomes necessary.

In summarizing one can say that practically all the contributors agree that obstruction due to prostatic carcinoma should be relieved by transurethral electric surgery. Though widely varying modes of treatment are favored and employed, a curative measure which is reasonably safe and reasonably successful has not as yet been found.

BIBLIOGRAPHY

1. Barringer, B. S. Am. J. Roentgenol., 1937, 37: 49.
2. Blumel, P. Med. Klin., 1936, 11: 1247.
3. Burnam, C. F. Urol. & Cutan. Rev., 1938, 39: 75.
4. Caulk, J. R. J. Urol., 1937, 37: 832.
5. Chauvin, E., and Mosinger, M. J. d'urol. méd. et chir., 1937, 44: 97.
6. Ferguson, R. S. J. Urol., 1937, 37: 774.
7. Hager, B. H., and Hoffmann, E. F. J. Urol., 1937, 37: 180.
8. Higgins, C. C., and Crowell, R. C. Cleveland Clin. Quart., 1937, 4: 116.
9. Houdard, L., and Mouchet, A. Presse méd., Par., 1936, 92: 1820.
10. Keyes, E. L., and Ferguson, R. S. Brit. J. Urol., 1936, 8: 352.
11. Kolmert, F. Chir. Univ. Klin. Uppsala, 1936, N. F. 42: 285.
12. Lasio, G. B. Atti d. Soc. ital. di urol., 1936, p. 82.
13. Myers, G. M. Colorado Med., 1937, 34: 248.
14. Nitch, C. A. R. Brit. J. Urol., 1936, 8: 329.
15. Pfahler, G. E. Surg., Gynec. & Obst., 1937, 64: 989.
16. Schanz, F. E. Ztschr. f. urol. Chir. u. Gynaek., 1936, 42: 292.
17. Smith, L. D. J. Urol., 1937, 38: 375.
18. Young, H. H. Surg. Clin. North Am., 1936, 16: 1273.
19. Idem. Surg., Gynec. & Obst., 1937, 64: 472.

GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Braasch, W. F., and Hammer, H. J.: Renal Fusion: Urograph Data and Their Clinical Significance. *Brit. J. Urol.*, 1938, 10: 219.

The clinical recognition of renal fusion has become more frequent in recent years as a result of the routine use of excretory urography. Clinical recognition by this method was possible in 95.5 per cent of 102 cases reviewed. There is need for a simpler terminology. Adopting the vertebral column as an anatomical basis, renal fusion may be classified as bilateral, unilateral, and prevertebral. This eliminates the necessity of using such indefinite terms as "horseshoe" kidney, "caked" kidney, and "crossed renal dystopia."

Careful inspection of the renal outline in the original roentgenogram should permit recognition of bilateral fusion in about half of the cases. The recognition of unilateral fused kidney by its outline is less frequent. The arrangement of multiple shadows of stones and the characteristic outline of large single stones in cases of renal fusion will often indicate the presence of the anomaly.

The position of the renal pelves in cases of bilateral fusion is variable, but the following features are of interest: (1) the low level of one or both renal pelves in relation to the vertebræ—more than 60 per cent being below the third lumbar vertebra—and (2) the proximity of the right pelvis to the vertebral margin being greater than that of the left pelvis. Although the two pelves usually are situated closer together than normally, the distance separating them is not uniform and it may be so great that the presence of fusion would seem impossible. In one case, the distance separating the pelves was 16.7 cm. Approximation of the pelves with renal dystopia may simulate fusion. Although the pelves in cases of renal fusion are frequently fixed by surrounding tissues, considerable excursion may be visualized in one or both segments.

In differential diagnosis, which may be difficult, the possibility of the presence of the following conditions should be eliminated: (1) bilateral renal fusion and incomplete renal rotation with ectopia, and (2) unilateral renal fusion and crossed renal dystopia without fusion. Recognition of the presence of prevertebral fusion may be difficult when the lower pelvis is obscured by the vertebral shadow, or when there is insufficient function in that segment. Probably the most significant diagnostic factor in the recognition of fusion is the characteristic axis of the lower calix, which is usually directed toward the isthmus. In cases of unilateral fusion, the relation of the pelves to one another in the urogram may be of surgical importance. In many cases, the two pelves are so closely interrelated that separation of the renal segments would be difficult or impossible.

Evidence of dilatation in either the calices or the pelves, or both, is associated with many cases of renal fusion. This usually indicates the presence of stasis, although in some cases it does not. Pyelectasis and caliectasis were sometimes observed among patients who never had pain. Lumbar pain is sometimes observed among patients who do not have evidence of pyelectasis or caliectasis. Fused kidneys removed at necropsy may show gross evidence of a minor degree of pyelectasis without apparent ureteral obstruction. In some cases, this may be a residual deformity caused by previous obstruction. In other cases, however, it may be inferred that pyelectasis is a congenital abnormality rather than a pathological complication. The existence of renal stasis can best be demonstrated by the use of delayed retrograde urography, and renal stasis will be found present to a variable degree in many cases of renal fusion. It may be a variable factor in indicating the cause of obscure lumbar or abdominal pain.

Gayet, R.: The Value of Retrograde Ureteropyelography in Carcinoma of the Kidney (Intérêt de l'urétéro-pyélographie rétrograde dans le cancer du rein). *Lyon chir.*, 1938, 35: 385.

Carcinoma of the kidney is a condition which calls for prompt diagnostic investigation. Retrograde ureteropyelography has become of the greatest aid for the diagnosis of this condition. All urologists agree that this method is by far the most reliable for the visualization of lesions involving the excretory ducts.

Not only is ureteropyelography of diagnostic value, but it also throws some light upon the anatomical and pathological features of the malignancy and its degree of invasion into neighboring structures, and it prepares the surgeon for certain difficulties which he may encounter during surgical intervention.

The most reliable results are obtained in carcinomatous lesions which are still limited but in definite course of evolution. At this stage retrograde pyelography is one of the most efficient and most reliable methods of diagnosis. In advanced lesions the pyelogram shows distinctly the degree of invasion of the kidney by the tumor, but the site of origin of the lesion can usually not be traced.

The various types of renal carcinoma and their pyelographic aspects may be briefly described as follows: in general, malignant changes involving the renal pelvis and the collecting tubules are more easily visualized than lesions involving the renal cortex. Malignancies of the renal cortex should be suspected by changes of the normal renal contour, by an increased volume of the kidney, and by renal displacements.

Retrograde ureteropyelography is of great importance in formulating the surgical indications and

contraindications. In tumors associated with mild clinical symptoms and in the presence of a kidney of normal volume the pyelogram of which shows the presence of a well localized tumor either in the pelvis or in the parenchyma, hesitation to proceed surgically is not justified. Nephrectomy becomes absolutely imperative in these cases even in spite of certain difficulties that may arise during operation.

In the presence of more advanced lesions, in which one of the renal poles is involved, surgical intervention is imperative as long as the patient is still in a reasonably good condition. The type of surgical approach depends primarily upon the site of the lesion. In this group, the immediate postoperative results were good, but recurrences could not be excluded because of the lymphatic extension. It is therefore a good plan, especially in the presence of enlarged lymph glands, to remove these glands as extensively as possible, care being taken not to open any blood vessels unnecessarily, especially on the right side. Obviously the results obtained in this group were not as favorable as those obtained in the preceding group.

In the presence of very advanced lesions, it was formerly customary to proceed surgically even in extremely cachectic cases, but in the light of our present knowledge it has been found safer to desist from any surgical interference, both because of the frequency of recurrences, and because of the frequency of surgical accidents.

RICHARD E. SOMMA, M.D.

BLADDER, URETHRA, AND PENIS

Puigvert-Gorro, A.: Primary Tuberculosis of the Urinary Bladder (La tuberculose vésicale primitive). *J. d'urol. méd. et chir.*, 1938, 46: 113.

The urinary bladder was formerly considered as the primary focus of tuberculous infection spreading to the remaining regions of the urinary apparatus. Later, the kidneys were shown to be the primary location of urinary tuberculosis in the majority of cases, and therefore the first hypothesis has been abandoned.

The author reports a case of primary tuberculosis of the urinary bladder in a twenty-seven-year-old woman. Numerous examinations over a period of one year convinced him that the tuberculosis remained confined to the bladder, and demonstrated the existence of a primary tuberculosis of this organ independent of other latent or doubtful localizations of the specific infection.

A genital or ascending mode of infection of the urinary bladder can be accepted only with great skepticism. Several authors speak of the lymphatic vessels as the pathway for the infection of the bladder, especially in cases of secondary cystitis accompanying specific rectal lesions, but this hypothesis lacks a definite proof. The descending or ureteral mode of infection may be admitted in some cases, but usually the hematogenic route of infection must be suspected.

JOSEPH K. NARAT, M.D.

GENITAL ORGANS

Retlev-Abrahamsen, H., and Aalkjaer, V.: The "Pseudo-Uremia" of Patients with Prostatic Hypertrophy — The Nephrogenous Acidosis. *Brit. J. Urol.*, 1938, 10: 231.

Most patients with prostatic hypertrophy have definite symptoms of reduced kidney function and a disturbance of the balance of fluids. There is an increase of urea in the blood and the results from kidney-function tests are poor. It is a well known fact that adequate treatment (self-retaining catheters and abundant fluids) can benefit these patients considerably in a few days. It is, however, also a fact that in many patients this "pre-operative drainage period" progresses slowly. The urea content of the blood will not decrease, the general condition will not improve, and the symptoms of lack of fluid balance remain. Under these conditions, the risk of complications, such as pulmonary and urogenital inflammations, phlebitis, and cardiac accidents, is increased.

At the Bispebjaerg Hospital, Copenhagen, these changes in the kidney function and in the entire condition of the organism, have been studied in prostatic patients. Patients in whom tests show bad function, in spite of regular treatment, are generally believed to have a genuinely irreparable uremic condition. However, systematic investigations have proved that this serious clinical picture in most of the patients is caused by an acidosis. By treating this acidosis the authors have succeeded in bringing most of these patients to a state which permits operation in a short time.

Patients with reduced plasma bicarbonate values are given a freshly prepared 1.3 per cent sodium bicarbonate solution (isotonic) intravenously, but this remedy must be used in quantitative doses based upon the analysis and the patient's body weight. An overdosage will cause an alkalosis with the danger of tetany. The calculation of the necessary amount of sodium bicarbonate is simple if the nomogram of Palmer and van Slyke is used.

Prostatic patients with nephrogenous acidosis always have dyspeptic symptoms at the same time, and are dehydrated; therefore, in most cases it is impossible to administer sodium bicarbonate by mouth, and it would be hazardous to inject it intravenously in concentrated form. The solution cannot be sterilized by boiling as it would disintegrate, and for this reason it is not well suited either as a subcutaneous injection, or as an intramuscular injection. The authors state, however, that when the solution is freshly prepared no ill effects have been observed in its use intravenously. Alkali treatment is thus suitable only for hospitalized patients and should be administered only quantitatively on the basis of frequent plasma analysis.

Since the introduction of these investigations at the Bispebjaerg Hospital, nephrogenous acidosis has been detected and treated in about one-third, or 29, of 123 patients with prostatic hypertrophy, and in

many patients with surgical kidney diseases. Often 1 liter, or just a few liters of the sodium bicarbonate solution were sufficient to produce a normal plasma bicarbonate figure. In individual cases, however, it has been necessary to administer up to 10 liters of the solution.

Knowledge of the nephrogenous acidosis has made it possible to offer a greater number of patients transurethral resection of the prostate after but a few days' treatment. In a group of 112 patients in whom the hypertrophy was not complicated by stones and upon whom operation had not previously been performed, resection could be performed, in the cases of 77, before the tenth day, generally from the fourth to fifth day after admission.

Thus, the attainment of a normal electrolytic balance in the body is necessary for the maintenance of a normal fluid balance. Besides shortening the preoperative period, alkali therapy has, in a number of cases, proved itself valuable in the treatment of severe postoperative complications (bleeding, and ascending infection of the urinary tract), in which increased demands are made on the kidney function. As a result of these findings, examination for, and treatment of, nephrogenous acidosis must be considered indispensable in prostatic surgery.

C. Travers Stepita, M.D.

Cibert, J.: Some Points in the Technique of Transurethral Prostatic Resection (Quelques points de la technique de la résection prostatique trans-urétrale). *J. d'urol. méd. et chir.*, 1938, 46: 5.

Cibert notes that it should be remembered that transurethral resection as used in the treatment of prostatic hypertrophy is a true resection, not a "channeling operation," and that as much tissue as possible should be removed. It is not a substitute for prostatectomy in all cases, but it gives relief in many cases in which prostatectomy involves too great a surgical risk without the necessity of a permanent cystostomy.

American urologists have developed the technique of transurethral prostatic resection to a high degree of perfection. One of the important developments in this respect is the use of various optical systems for pre-operative examination of the field and for the control of the progress of the operation and the amount of tissue to be removed. In addition to oblique vision, right-angle and retrograde vision is obtainable. Right-angle vision is particularly useful during operation for showing the relation of the tissue to be resected to the ureteral orifices. The retrograde vision is of especial value at the close of the operation to reveal any remaining tissue that should be removed so as to leave a smooth surface. Oblique vision at the close of the operation should show the upper pole of the verumontanum and the bladder cavity in the same field.

Resection operations, even with careful visual control, occasionally do not give satisfactory results. In some cases a small fold of tissue may be left which may interfere with satisfactory emptying of the bladder. In other cases, as American authors have noted, the space cleared by the resection appears on re-examination to be partially filled again by pathological tissue; they attribute this to a tendency of the adenoma to push into the free space that has been created. The author has observed 1 case of this kind, in which after the removal of 9 gm. of the tissue from a small adenoma, urination was still difficult; endoscopic examination showed the presence of considerable tissue at the lower pole of the two lateral lobes; 14 gm. of this tissue were resected with subsequent relief of symptoms. Such occurrences are rare, and they do not decrease the importance of optical control by the newer methods.

The importance of retrograde vision has been shown in 2 of the author's cases. In one, it demonstrated a small calculus lodged behind a projection of tissue at the bladder neck. In the other, a resection done when an optical system with oblique vision only was available gave the patient considerable relief, but was not deemed satisfactory as considerable residual urine persisted. A second examination with retrograde vision showed a fold of tissue at the right side of the bladder neck. Removal of this tissue resulted in normal micturition with satisfactory emptying of the bladder. Alice M. Meyers.

Gutiérrez, R.: Carcinoma of Cowper's Gland (El cáncer de la glándula de Cowper). *Med. rev. mex.*, 1938, 18: 251.

From a study of the literature it appears that the surgical conditions of Cowper's gland have received little attention. Altogether only 5 cases of cancer of this gland have been described. In females the Bartholin glands, which are homologous to Cowper's glands in the male, are more frequently found to be the seat of carcinomatous processes. This report is based on the author's personal observation of a primary carcinoma of Cowper's gland which had been diagnosed and operated upon by him.

After having reviewed the literature on this subject and discussed the anatomy and embryology of these glands, Gutiérrez briefly summarizes the most commonly encountered pathological changes, such as: (1) chronic inflammation, (2) acute inflammation, (3) cystic changes, (4) tuberculosis, (5) calculosis, and (6) tumors.

The case reported by the author was that of a seventy-year-old man presenting a history of an old gonorrheal infection. For many years he was being treated for a urethral stricture. When seen at the clinic the urethra was found to be very sensitive and the patient complained of a marked dysuria and nocturnal frequency. Upon closer examination both Cowper's glands were found to be markedly hypertrophic and indurated. Histological examination of a specimen of this gland removed at operation revealed the presence of a primary adenocarcinoma.

From a study of this patient and the cases reported in the literature the author concludes that pathological processes involving Cowper's glands are clinically very rarely diagnosed correctly. The incidence

of conditions involving this gland, therefore, must have been estimated as being much lower than it actually is.

The symptoms of carcinoma of the bulbo-urethral glands are easily confused with those arising from conditions involving the rectum and the lower urinary tract. The most outstanding symptomatic features are pain in the rectum and in the perineum, and urinary disturbances which may be so severe as to cause complete urinary retention. The treatment is surgical and consists in the complete removal of the involved glands. The operation is followed by the application of radium needles and deep radium therapy.

The prognosis is serious in every case and none of the patients in the 5 cases reported in the literature is said to have recovered permanently. It is probable that with the aid of better diagnostic methods and an adequate surgical approach satisfactory results will be obtained. RICHARD E. SOMMA, M.D.

MISCELLANEOUS

Pyrah, L. N., and Fowweather, F. S.: Urinary Calculi Developing in Recumbent Patients. *Brit. J. Surg.*, 1938, 26: 98.

The morbid anatomy and symptoms of urinary calculi occurring in recumbent patients are described. The etiological factors are discussed and it is considered that the most important are general and local decalcification of bone, dehydration of the patient, stasis in the renal calyces and pelvis as a result of the recumbent posture, and dietetic and other factors resulting in the production of a non-acid urine. The measures which are desirable for the prevention of recumbency calculi are outlined, and it is shown that in reported cases of calculus formation it is possible to cause the calculi to go into solution if appropriate treatment is carried out and the calculi remain aseptic. If the calculi are associated with gross infection of the urine, surgical intervention for their removal is required.

D. E. MURRAY, M.D.

Adair, F. L., Dunlap, H., and Willmert, G.: The Mechanism of the Action of Pyridium. *J. Urol.*, 1938, 40: 319.

In investigating the mechanism of the action of pyridium, the authors have endeavored not only to recheck its bacteriostatic and germicidal action and to determine the factors, such as concentration and pH, which influence these actions, but also to discover by what other means the drug may affect infections of the urinary tract. Antitoxic, anesthetic, chemotactic, and tissue-stimulating activities, and the reduction of virulence of the infecting organisms are all possible methods of action which heretofore have been investigated little or not at all.

In infections of the urinary tract, the average concentration of pyridium in the urine of patients given 0.6 gm. of the drug daily was found to average less than 1:20,000. With a restricted water intake of 2,000 c.cm. or less daily, an average concentration of 1:10,000 was obtained. Certain strains of bacteria are able to change pyridium by reducing it to a green substance.

Urine containing eliminated pyridium was shown to have no consistent germicidal power. Raising or lowering the pH of the urine as it was eliminated with an acid or alkaline-producing diet and the administration of drug had no effect on the germicidal power of the pyridium-containing urine. Pyridium is not an active chemotactic agent. Growing escherichia coli and staphylococcus aureus with pyridium did not reduce the virulence of either of these organisms. Escherichia-coli endotoxin was not neutralized by incubation with pyridium. The production of endotoxins is not suppressed by pyridium. Pyridium does not diminish the toxicity of diphtheria toxin or staphylococcus toxin.

Pyridium *per se* and pyridium eliminant in the urine are both capable of suppressing the production of staphylococcic toxin *in vitro*. This suppression is easily detected and definite, and is not explained entirely by the bacteriostatic effect of pyridium in the cultures producing toxin. Such action may explain wholly or in part the beneficial effect of the drug on infections of the urinary tract caused by the staphylococcus.

The decrease of toxin production by the staphylococcus is dependent on the constant presence of pyridium and does not become a permanent property of organisms grown in its presence. Most of the hemolytic strains of staphylococci from urinary-tract infections which were studied were capable of producing hemolysin and skin-necrotizing toxin. No toxin could be detected in the urine filtrates of these cases.

Pyridium appears to inhibit the multiplication of hemolytic streptococci but apparently has no effect on anaerobic streptococci. Growing hemolytic streptococci or staphylococci in pyridium broth causes no change in the colony formation or the hemolytic zone. C. TRAVERS STEPITA, M.D.

THE PRESENT STATUS OF TREATMENT OF FRACTURES OF THE CALCANEUS

Collective Review

RUDOLPH S. REICH, M.D., F.A.C.S., Cleveland, Ohio

IT is only approximately fifteen years that attention has been paid to the problem of corrective treatment of fractures of the calcaneus in spite of the fact that they constitute the most disabling disabilities in the realm of fractures. Unlike fractures of the neck of the femur, comminuted fractures of the calcaneus occur almost exclusively in working men, for whom the period of disability is so vital, particularly from the standpoint of economics and industrial efficiency.

A great deal of credit is due to Cotton for his interest; his early papers contributed greatly to this subject. His interpretation of the disability was an outward broadening of the calcaneus from lateral impaction of the peroneal plate and a new growth of bone behind it, with impingement against the external malleolus, pinching of the peroneal tendons, and painful limited lateral movement, due either to blocking of the posterior subastragalar joint, shortening of the slide, or new bone being heaped up anterior to the malleolus. For treatment he suggested the removal of spurs and excision of the impacted portion of the calcaneus beneath the external malleolus, followed by forcible manipulation in all directions to remove obstacles to normal motion. For a shortened and flattened heel he suggested cross-sectioning of the calcaneus behind the posterior portion of the subastragalar joint and molding of the heel in a plaster-of-Paris bandage. Subsequently Funston made a more concentrated effort to overcome the shortening and upward displacement of the fractured calcaneus by pulling it plantarward with the aid of a urethral sound placed anteriorly to the Achilles tendon and on top of the calcaneus, at the same time breaking up the lateral impaction with a mallet and bandage, and applying the plaster-of-Paris cast with the bandage in place under the external malleolus. This was followed by Boehler's treatment of recent fractures, and his work has given the subject of fractures of the calcaneus a real impetus. His treatment will be described later.

Fractures of the calcaneus may be roughly described as recent and old fractures. The interest in the old fractures is mainly directed to those patients who have not received adequate treatment or have painful disabling heels in spite of adequate treatment. Recent fractures of the calcaneus may be subdivided into fractures without displacement and with displacement. Boehler offers an excellent classification of these fractures, which is as follows: (1) fractures of the upper part of the tuberosity, the so-called "beak fractures," which are very rare; (2) fractures of the medial part of the tuberosity with or without displacement; (3) fractures of the sustentaculum tali alone; (4) fractures of the body of the calcaneus without displacement of the joint surfaces articulating with the talus; (5) fractures of the body with displacement of the lateral parts of the posterior articulation with the talus; (6) fractures of the body with displacement of the whole of the posterior surface articulating with the talus—a wide space is seen in the lateral roentgenogram between the posterior part of the talus and the calcaneus; (7) fractures of the body with displacement of the lateral portion of the posterior articular surface, with accompanying subluxation between the head of the talus and navicular and between the front of the calcaneus and the cuboid (subluxation of the midtarsal joint)—the posterior process of the talus is sometimes broken off; and (8) fractures of the body with crushing of the anterior portion and dislocation of this from the cuboid. Boehler also mentions three pathological fractures of the whole of the tuberosity in cases of tabes and infantile paralysis.

Schofield also presents an excellent classification, consisting of five types of fracture, listed in our tabulation.

THE DIAGNOSIS OF RECENT FRACTURES

When one outlines the proper treatment of comminuted fractures of the calcaneus, it is necessary first to obtain an accurate diagnosis of the type of deformity with which one has to deal. Many writers, particularly Funston, Boehler, Hermann, Yoerg, and Felsenreich, stress the importance of accurate roentgenograms from various angles.

Hermann describes in detail the method of taking roentgenograms, suggesting first an axial view; second, a plantar view; and in a severe case, a third view, to be taken in an effort to see the subastragalar joint more clearly.

Boehler calls attention to the tuberosity joint angle which he describes as follows: "If two lines are drawn along the upper aspect of the calcaneus one from the highest point to the anterior angle and the other from the highest point to the upper part of the tuberosity, these two lines will normally make an angle of 140 degrees to 160 degrees with each other, the complementary angle being 20 degrees to 40 degrees." (Fig. 1) "The latter sharp angle is easier to measure and to estimate by the eye, and I call it the 'tuberosity-joint angle.' (For simplicity this is referred to as the 'salient' angle.) After a fracture of the calcaneus, this angle becomes smaller, disappears entirely, or is reversed."

Any deviation from the normal angle is an excellent guide to the amount of deformity with which one has to deal, particularly from the lateral view.

Fig. 1. Angle between the calcaneal tubercle and joint of 38 degrees in a normal foot. (Boehler: Technik der Knochenbruchbehandlung.)

THE TREATMENT OF RECENT FRACTURES

Boehler has subdivided comminuted fractures into eight groups, and has also specified treatment for each type of fracture, although the treatment of Groups 4 to 8, inclusive, is universal.

For the first group, he suggests the injection of 20 c.cm. of 2 per cent novocaine solution into the fracture area, after which the tendo Achillis is relaxed by the knee being bent to a right angle and plantar flexion of the foot. The upward rotating fragment is replaced by little-finger pressure. A U-shaped plaster splint is applied in slight flexion (10 degrees) and molded above the prominence of the heel on both sides of the tendo Achillis. A posterior splint and two circular plaster bandages are applied over this, a walking iron is attached the next day, and the patient is allowed to walk. The plaster remains applied for six weeks.

For the second group, Boehler recommends the application of an unpadded plaster-of-Paris walking cast for six weeks, the patient being permitted to walk at once.

Fractures confined to the sustentaculum with displacement of the fragments inward are reduced by means of a compression clamp under general anesthesia and further treatment is similar to that of the last group.

For treatment of Groups 4 to 8, inclusive, the following will be required: (1) lateral and oblique plantar-dorsal roentgenograms and in fractures of the anterior portion a dorsoplantar view of the injured side with a corresponding picture of the sound side for comparison; (2) spinal anesthesia; (3) a strip of felt from 40 to 50 cm. long, 4 cm. wide, and 3 mm. thick; (4) mastisol; (5) a stainless steel Steinman pin 4 mm. thick and 15 cm. long, with 2 fixation screws; (6) a similar pin 5 mm. thick; (7) and (8) rotating stirrups to fit the 2 different sized pins; (9) a hammer; (10) a screw traction apparatus; (11) a spring balance; (12) a screw compression clamp for the heel with pads; (13) four plaster bandages 5 m. by 15 cm. and 400 gm. of weight; (14) a muslin bandage 10 m. by 12 cm.; (15) a well bandaged Braun's splint; and (16) a bed with fracture boards.

The leg is placed in a Braun splint for from six to ten days until most of the swelling has disappeared. Under spinal anesthesia, the remainder of the swelling is overcome by kneading with both hands. Following surgical preparation, the Steinman pin is driven through the posterior angle of the tuber calcanei in order that better leverage be obtained, and is fitted with a rotating stirrup. With the knee bent at a right angle, the leg is placed in a screw traction apparatus with the stirrup on the heel pin attached to the spring balance and this in turn to the hook of the screw. Twenty to 30 kilos of traction are applied to the long axis of the lower leg. The tuberosity is thus pulled down and the tuberosity angle is restored. With axial traction maintained, another pin is driven through the tibia 3 or 4 finger breadths above the medial malleolus parallel to the pin in the heel, which is fitted with a rotating stirrup and hung to the transverse bar of the screw traction apparatus. The screw is then released, the bar of the screw apparatus is lowered, and a traction of 20 kilos is made obliquely downward in the long

axis of the calcaneus, the forefoot being flexed plantarward and pronated at the same time. The screw is again released, its position raised, and a longitudinal traction of 20 kilos again applied in the axis of the leg. This maneuver overcomes the angulation, the shortening, and to some extent the widening of the heel bone. The talus is pulled away from the calcaneus and the joint between the two bones is restored. The lateral impaction under the external malleolus is compressed by the application of the compression clamp while the longitudinal traction is maintained. A felt pad is applied on the lateral side and a concave pad on the medial side below the sustentaculum tali. The compression screw is quickly tightened until the pads have moved toward one another to a distance of 35 mm. and released immediately so as not to damage the skin.

Pieces of cork are placed on the ends of the pin so as to prevent scratching of the hands and a plaster splint 100 cm. long is applied from the hollow of the knee to the ends of the toes and fastened loosely by two circular plaster bandages. After the plaster has set, the screw traction is released, the stirrup removed, and the leg laid on a Braun splint. Reduction is checked by lateral and oblique dorsal-plantar roentgenograms. If the tuberosity joint angle has not been completely reduced, reduction should be again undertaken. The Steinman pins are fastened with plaster-of-Paris by means of fixation screws to prevent rotation. One week after reduction, a walking iron is attached and the patient is allowed to walk.

The cast and pins are removed ten weeks after the injury in fractures of Group 4. In Groups 5 to 8, inclusive, the cast is removed after from eleven to fourteen weeks, the time depending upon the degree of original comminution. The majority of cases of fractures of the calcaneus show very marked decalcification of the tarsal bones, and weight-bearing on the foot is painful. Boehler recommends an Unna's paste dressing for several months to prevent swelling, and in addition an arch support is supplied. At the same time, physiotherapy is employed.

Fractures of Group 6 are comparatively rare but present more difficult problems of reduction. This is accomplished by means of the Phelps-Gocht apparatus. Before reduction is attempted, three thick felt pads are applied to the skin. Powerful pressure is exerted on the middle of the plantar side of the calcaneus while the tuberosity is pulled downward, with rotation around the transverse axis. The head of the talus and the front part of the calcaneus are thus brought down and the angulation is abolished, the downward displaced portion of the posterior articular surface being pushed up toward the talus. The Phelps-Gocht apparatus is then removed and reduction is carried out by the screw traction apparatus fixed by a pin.

In some instances, particularly in old people with arteriosclerosis, it may be desirable to carry out the treatment by continuous traction. In these cases a Steinman pin is driven through the calcaneus, and mastisol is applied below the knee joint and to the dorsal and plantar sides of the foot. A long strip of felt is placed below the knee and a broad one on the back of the foot. Another piece 10 cm. long is placed transversely across the sole of the foot at the level of the midtarsal joint. A plaster splint is applied along the extensor surface of the foot and leg from the cleft of the toes to the knee. The short splint is applied from the midtarsal joint to the tips of the toes on the sole of the foot. These splints are attached by means of a muslin bandage and two circular bandages are wound around them, the heel not being included. The leg in the cast is then placed on a Braun splint and the foot slung by means of a bandage to the transverse bar. The pin is fitted with the rotating stirrup, a 5-kilo weight is attached, and traction is applied to the heel. After eight days lateral and oblique dorsal roentgenograms are taken and if the tuberosity joint angle has not been restored, lateral impaction is reduced by means of a compression clamp applied under short ethyl-chloride anesthesia. The leg remains on the splint with traction from nine to thirteen weeks.

Hermann has suggested a more conservative form of treatment. The foot and lower leg are encased in a pillow splint with appropriate bleb dressings and ice bags if necessary. When the acute local reaction has subsided, a one or two-day "bone prep" is given.

The operating kit contains a tightly rolled sterile towel, a sandbag with a sterile cover, a 7-lb. large wooden mallet, a pair of bone tongs, a Forrester bone clamp, a sawed-off crutch, a scalpel, a sterile dressing, and 2 rolled pieces of felt bound by adhesive (4 in. by 1¼ in.). Besides this kit, the usual sheet-wadding and plaster-of-Paris bandages are required.

Following a light dosage of low spinal anesthesia or gas-ether anesthesia, the patient is turned on the side opposite the injury and a sandbag is placed under the inner side of the heel. The tightly rolled towel is placed beneath the external malleolus and with solid heavy blows the piled-up bone beneath the external malleolus (Fig. 2) is pounded down until the normal depression beneath the external malleolus is restored, which

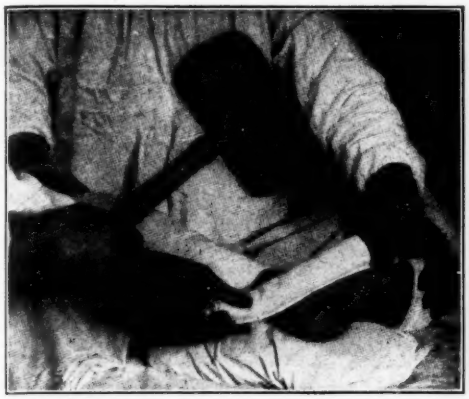

Fig. 2. Patient turned on side opposite injury. The sandbag is placed under the inner side of the injured heel. A sterile rolled towel is placed beneath the external malleolus. Then, with solid heavy blows, impaction is broken up and the piled-up bone beneath the external malleolus is pounded down. (Hermann: J. Bone & Joint Surg.)

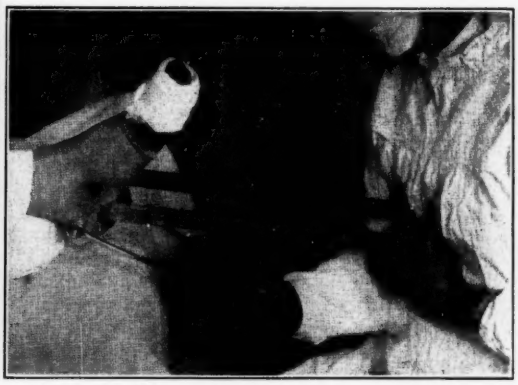

Fig. 3. With a scalpel, small incisions are made about an inch or so above the apex of the heel. The tongs are driven in and locked, and traction is then made in a rotary fashion, beginning downward and swinging upward, with countertraction exerted just proximal to the cuboid joint. (Hermann: J. Bone & Joint Surg.)

condition is gauged by the thumb being placed in this depression; if the thumb nail is on a level with the outer surface of the external malleolus it is considered satisfactory. This procedure has been named "disimpaction." Offhand it would seem that such heavy pounding would cause terrific bruising of the tissue with resulting necrosis, but the tightly rolled towel with the broad-faced mallet precludes such damage. The heel is quickly molded by hand and the various motions are tested. The testing of motions, particularly the lateral, is important. It has been pointed out that this reduction may be lost in part or in whole as a result of the procedure just described, but if it is not done, it is impossible to determine whether a submalleolar bone block still exists. Whatever is lost at this stage in the reduction is regained immediately by traction and remolding.

Small stab wounds are then made in the upper posterior part of the heel, care being taken that no fracture lines are entered. The tongs are driven in and locked, and with countertraction from the crutch, which has its handle resting against the operator's abdomen or chest and the cross-bar of the sawed-off end resting against the sole of the foot in the line of the calcaneocuboid and the astragaloscaphoid joints, lusty traction is made in an arcwise fashion (Fig. 3). This pull begins in a downward and outward direction and with well-sustained traction is carried upward and toward the operator. This type of pull was adopted to overcome the posterior vertical pull by the intrinsic muscles of the foot. It is here that the value of the preliminary disimpaction is felt—the large posterior fragment can be pulled down, whereas if it were left impacted only a long-continued traction could do this.

The tongs are now removed and the heel is remolded by the use of the Forrester bone clamp (Fig. 4). When the desired compression has been obtained with this clamp the traction is again applied through the clamp. The entire heel is carefully and systematically molded in this fashion. The heel is again examined manually and

Fig. 4. The os calcis is remolded systematically from the external malleolus downward by means of the Forrester clamp. Again traction is exerted downward and upward with counterpressure in the os calcis and cuboid areas. (Hermann: J. Bone & Joint Surg.)

check-up roentgenograms are made. Tightly folded sterile dressings are placed over the stab wounds in the heel and held in place by a sterile gauze strip wound about it. A snug roll of felt is carefully placed at a very slightly oblique angle beneath each malleolus. A low plaster-of-Paris cast is applied with the foot in slight inversion and extreme plantar flexion. Manual pressure is applied over the pad areas while the cast is hardening. The first cast is removed in two weeks and a new cast applied with the foot at right angles and with the submalleolar pads carefully replaced. A new cast and pads are reapplied every two weeks up to ten, and occasionally twelve, weeks in order to check up on the condition of the skin. After removal of the last cast a special ambulatory calcaneus splint is applied at once. This is followed by physiotherapy in the form of daily massage and active foot and ankle movements. Full weight-bearing is permitted without crutches ten days or two weeks after the removal of the last cast. At the end of another six weeks the ambulatory splint is gradually discarded and the patient is instructed to exercise more strenuously and increase walking on rough surfaces.

Yoerg's method of reduction is even more simple. Roentgenograms having been taken, the patient is placed in bed with the foot elevated and hot packs applied. The reduction of the fracture is done under general anesthesia to obtain complete relaxation. The patient is placed on a firm table on his side in order that the injured foot may be brought laterally to the edge of the table with the heel extending over the edge. The left hand firmly grasps the ankle and the leg just above. The heel is grasped with the right hand and the fracture manipulated laterally with the ball of the hand, a repeated thrusting force being used until the fracture has been thoroughly disimpacted. An unusual amount of force is necessary and it is imperative that a firm grip be maintained with the left hand so that fracture of the leg be avoided. After thorough disimpaction with flexion of the knee and plantar flexion of the foot, the surgeon grasps the heel and with a sudden thrust pulls it down. When an upward displacement is present because of a flattening or crushing of the posterior joint surface, the surgeon brings the bone down by grasping the heel with one hand, the forward portion of the foot with the other hand, and pulling the sole of the foot with a sudden thrust against a firm vertical bar. An os calcis clamp is then employed to squeeze the loosened bones into position. The clamp is used to reduce the broadening and shortening of the back portion of the heel. If a fracture and spreading are present in the anterior portion of the bone, the clamp should be moved forward and reapplied.

An assistant applies a moderately padded cast to the foot, ankle, and leg to just below the knee. The patient is pulled down on the table with the leg hanging at right angles over the edge. The surgeon, sitting on a low stool, molds the cast well around and under the malleoli, back of the heel, and under the arch of the foot, keeping constant traction on the heel with the knee at right angles and the foot in plantar flexion. The tendon in this position is completely relaxed and the cast molded as described will hold the reduced fragments in apposition.

A roentgenogram of the foot is taken and if reduction is satisfactory the patient is allowed to be up and about on crutches in a few days, but he should not walk on the injured leg. The cast is removed four weeks after reduction and roentgenograms are made. The patient is instructed to massage and to move the foot and ankle actively and passively, but is not allowed to bear his weight on the injured foot. Two months after reduction another roentgenogram is taken and the patient is allowed to walk on the foot using his crutches. Strangely he does so without pain, and within a week, in most cases, he will discard his crutches and walk without support, in from two and one-half to three months from the time of reduction, and will have recovered sufficiently to return to his work. It has not been necessary in any instance to cut the heel tendon or to use pins or tongs to bring about or to maintain reduction. A modification of a Phelps-Gocht clamp has been used to bring down a badly comminuted heel and to hold it until the compression clamp could be applied to bring about lateral pressure.

Westhues suggests a method which he has found successful in a number of cases. Eight days after the fracture a nail is driven into the posterior fragment of the calcaneus (Fig. 5) and by means of this nail the posterior fragment is forced plantarward so that the upper angle of the calcaneus is restored. By means of pull on the nail in the longitudinal direction and through abduction of the nail (Fig. 6), the length of the calcaneus is restored and the adduction of the posterior fragment is replaced. An unpadded ankle plaster-of-Paris boot is applied with the nail in position and the foot in slight plantar flexion. The nail and the cast remain applied for four weeks, after which another unpadded cast remains applied for from two to three weeks.

The method of Lenormant and Wilmoth is based on the theory that it is necessary to raise

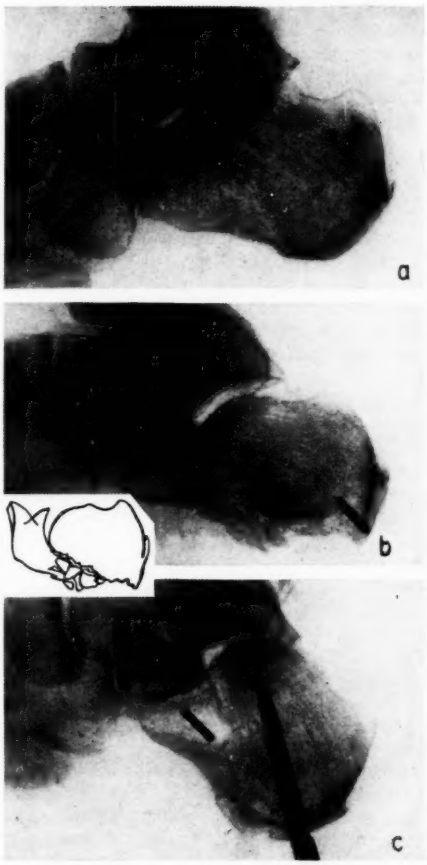

Fig. 5. Typical compression fracture of the calcaneus with considerable downward luxation of the posterior surface of the joint (b). The upper angle of the calcaneus is completely closed. For orientation in order to introduce the nail, 2 lead markers are used. A shows the calcaneus on the normal side. C shows the ideal result of reposition with the aid of the nail. (Westhues: Zentralbl. f. Chir.)

the thalamus to establish the normal movement at the articulation of the instep and the hinder part of the foot with the front part, the thalamus being maintained in its place by a material which would be well tolerated and permit this spongy bone to form a rigid, unimpressionable bony callus. A long angular incision exposes the lateral face of the fractured calcaneus. It is made behind the fibular epiphysis in the lower leg and descends vertically behind the lateral malleolus, below the tip of which it turns to become horizontal and parallel to the lateral body of the foot and is about

Fig. 6. Reposition with the aid of the inserted nail. The traumatic edema is carefully massaged away. Reposition is done about eight days after the fracture has occurred. (Westhues: Zentralbl. f. Chir.)

15 mm. above it. The horizontal part of this incision may be prolonged as far as the calcaneocuboid articulation. The cutaneous flaps are broadly separated, and uncover the entire face of the calcaneus, the lateral malleolus, and the talus. With the tendon elevator of Ollier the compact cortex is laid bare. A blunt dissector is introduced into the subthalamic fracture and without the least leverage on the underlying bone the spatula is inserted throughout the breadth of the calcaneus, following exactly the almost transverse course of the subthalamic fracture. The thalamus is kept held up by the spatula, and the grafts, taken in advance from the inner surface of the tibia, are introduced beneath it, two or three grafts being used, as necessary. The skin is carefully sutured, the leg and foot immobilized in a Boeckel splint or between two sandbags. Plaster is not applied until the sutures have been removed and the scar is clean. The patient is not permitted to put the foot on the ground, even in his cast, in less than four weeks. The plaster is left in place for at least two months. If the tibiotarsal mechanism is found to be stiff at the time the plaster is removed, mechanotherapy and massage are useful.

Kessler and Hermann call attention to the frequency with which fractures of the spine are found associated with fractures of the calcaneus (10 per cent in Hermann's series). Hermann recommends routine lateral and anteroposterior roent-

genograms of the lower thoracic and lumbar vertebræ to rule out such fractures.

THE TREATMENT OF OLD FRACTURES

As for old fractures, the disabling factors are most frequently: (1) pain in the subastragalar joint and occasionally involving the calcaneocuboid and astragaloscaphoid joints, especially when the patient is walking on uneven surfaces; (2) lateral impaction resulting in impingement of the peroneal tendons and, according to some writers, of the lateral malleolus; and (3) spurs or exostosis formation, particularly on the weight-bearing surface of the calcaneus. Most writers interested in the subject of old fractures agree that treatment for the first type is subastragalar arthrodesis and in some instances calcaneocuboid and astragaloscaphoid arthrodesis in addition. For the second type, excision of the impacted portion of the calcaneus under the lateral malleolus is recommended, and for the third, excision of all painful exostoses. The literature is in accord with the treatment suggested by Conn and the writer.

For relief of pain following old fractures of the calcaneus, Froehlich recommends novocaine infiltration into the periarticular ligaments. Immediate relief is experienced, and lasts for three months, after which time the injection may be repeated. Froehlich states that the results are good and lasting.

SUMMARY

In spite of Boehler's and Schofield's classification of fractures of the calcaneus, one might summarize the fractures as follows: (1) those without displacement or involvement of the subastragalar joint, and (2) those with displacement of the subastragalar joint, a loss in the tuberosity joint angle, anteroposterior foreshortening, and lateral widening with impaction under the lateral malleolus and occasionally spicules of bone which may result in excessive callus or spur formation.

The method of anesthesia is a subject in which there has been considerable variance. Boehler recommends the use of local anesthesia in some of his cases and in others he employs general anesthesia. Our experience has been most favorable with the use of avertin anesthesia supplemented with nitrous oxide and oxygen as the occasion arises. Spinal anesthesia has been reported in a number of recent papers.

The first group is treated by application of a plaster cast after the swelling has subsided. Treatment of the second group has made considerable progress in recent years, particularly by the impetus of Boehler's work. Both Yoerg's and Hermann's treatments must be considered a distinct advance as both men have reported a convincing number of favorable results following their methods.

Regardless of the variance in the types of treatment employed, the main principle is summarized as follows: to overcome the upward pull of the calf muscles and foreshortening resulting from the intrinsic muscles of the foot, restore the tuberosity joint angle, and overcome the lateral impaction. In some instances in which we have employed the Boehler method of reduction we have maintained the foot in Kirschner wires and on the Boehler calcaneus frame for a few days and then have incorporated the wires into plaster after some of the swelling has subsided and thoroughly checked the position by roentgenograms.

In the discussion of the end-results very few of the writers have expressed an opinion as to what their criterion of good results actually is. Since the subastragalar joint has been the determining factor as to disability, the question has always arisen whether or not there is pain in the joint on weight bearing, and as a corollary the patient has complained of less pain the greater the limitation of motion.

In a personal communication with Hermann and Yoerg, they have stated that in a great number of their cases with good results there has been complete restoration of function in the subastragalar joint and this is undoubtedly a definite advance in the treatment of this most intractable fracture.

As for early subastragalar arthrodesis for recent fractures, the results of Yoerg, Hermann, and others must unquestionably deny its value. However, to say that early arthrodesis should never be done is, in the writer's opinion, also too dogmatic, as unquestionably there are cases of severe comminution and impaction in which early arthrodesis would greatly shorten a prolonged period of disability. It is also possible that this group of cases may be diminished from time to time when our experience and technique in the reduction of these fractures improves.

As for the old fractures with disability, there has been no difference of opinion and obviously no alteration in treatment. Surely there is no hope of restoring the function of the subastragalar joint, and arthrodesis will overcome painful weight-bearing and locomotion in a great number of these old cases.

Since fractures of the calcaneus occur almost entirely in working men, the matter of disability, especially to compensation boards, is of vital importance. A survey of our tabulation is most

TABLE I.—RESULTS OF TREATMENT OF FRACTURES OF THE CALCANEUS

Author	Year pub.	No. of Cases	Method of treatment	Temp. total disability	Perm. part. disability
Kessler	1931	71	Various	3– 4 mo. usual 8–12 mo. unusual	20 to 25% min.
Funston	1933	52	Tenotomy. Mallet disimpaction. Cast. Arthrodesis if pain persists more than from six to eight mo. Weight-bearing in ten weeks	5½ mo.	23 to old jobs; 8 to other full time work; 5 not returned
Stewart	1934	36	Various. Recent cases manipulated and molded—Boehler. Unpadded walking cast. Subastragalar arthrodesis in 3	6–9 mo. in cases requiring arthrodesis	Of 30 followed up, 25 good; 5 poor
Forrester	1934	150	Tenotomy. Reduction by Boehler method. Cast 2 mo.; Unna's paste boot sixty days. Arthrodesis not indicated	4½ mo.	18%(Ill. State Ind. Commission)
Morrison and Flamson	1934		With no displacement: plaster three weeks, weight-bearing six weeks. Upward displacement: Kirschner wire traction. Plaster and pins four weeks. Physiotherapy. Weight-bearing four mo. Arthrodesis "last resort."	3 to 4 mo.	"End results good."
Green	1935	15	Closed. Cast with molded arch. Weight-bearing immediately.	3½ mo.	Ret. to previous occupation
Henderson	1936	22 recent 32 old	Method described by Gillette. Kirschner wire traction through tibia. Manipulation and casts choice if possible. Arthrodesis advised in 14; carried out in 3	"Cannot be given. Too many factors involved"	6—unknown 7—excellent 6—good 2—fair 1—poor
Schofield	1936	52	Type I. Avulsion fracture with medial displacement of sustentaculum tali. Compression and cast. Type II. Fracture of body; no displacement. Cast. Type III. Fracture of medial process of tuberosity. Boehler compression clamp. Type IV. Fracture of trochlear processor anterior portion of body of bone, involving cuboid articulation and possibly anterior facet of astragalus. Screw traction in 3; manual traction in 7. Unpadded walking cast. Type V. Comminuted fracture body with displacement and oftentimes compression and impaction; involvement of subastragalar joint and usually cuboid articulation; salient angle decreased, obliterated or reversed. Skeletal transfixion pins. Compression clamp and screw traction. Boehler frame. (Omitting 1 case with bilateral osteomyelitis) Case with osteomyelitis Average of 52 cases	5 mo. 3 mo. 5 mo. 7.5 mo. 7 mo. 2 yrs.	6% None 2.3% 2% 9% 25% 12%
MacAusland	1936	17	Boehler	"Impossible to estimate"	6 too recent 10 good 1 poor
Hosford	1936	82	Various. "Final result bears no constant relation to method employed"	3 mo. to 1 yr.	30 unknown 35 good 25 fair 12 bad
Jaekle and Clark	1937	43	Boehler Fractures of body Fractures of tuberosity Chip fracture into calcaneus Simple fracture neck of os calcis Average of 34 cases rated	 5.15 mo. 3.7 mo. 5.32 mo.	 15.1% 3.25% None except 1 —10% 2.4% 4.29%
McFarland	1937	63	Various. Six with closed reduction, molding and cast. Arthrodesis not advised	5 mo. to 2 yrs.	10 to 80%
Goff	1937	5	Closed reduction. Carpenter's clamp	4½ mo.	Only 1 case rated. Percentage not given
Yoerg	1937	26	See text	Of first 20 cases: 4—2½ mo. 8—3 mo. 5—4 mo. 2—5 mo. 1—over 9 mo.—improving	All of 20 but last one have returned to work
Hermann	1937	152	See text	6 to 7 mo. 7 to 18 mo. over 18 mo.	111 good 21 fair 20 poor
Bode	1937	219	69 treated by reduction and splint 37 treated by splint followed by cast 94 treated by reduction and cast 19 treated by wire traction		9.8% 15.6% 14.9% 21.6%
Spiers	1938	36	Boehler (28 rated)	6½ mo.	16 to old jobs 11 fair 1 bad

enlightening, as it shows a definite reduction in the percentage of disability in cases reported by various authors over a period of approximately seven years.

The extensive bibliography is an excellent testimonial to the interest in this most disabling fracture.

BIBLIOGRAPHY

1. Bode, P. Arch. f. orthop. u. Unfall.-Chir., 1937, 37: 649.
2. Boehler, L. Treatment of Fractures. Fourth English edition. Translated by E. W. Hey Groves. Baltimore: Wm. Wood & Co., 1935.
3. Conn, H. R. Ohio State M. J., 1929, 25: 629.
4. Cotton, F. J. Fractures and Dislocations. Second Edition. Philadelphia: W. B. Saunders Co., 1924.
5. Idem. Ann. Surg., 1921, 74: 294.
6. Felsenreich, F. Arch. f. orthop. u. Unfall.-Chir., 1935, 35: 590.
7. Forrester, C. R. G. Am. J. Surg., 1934, 25: 404.
8. Froehlich, F. Rev. de chir., Par., 1936, 74: 767.
9. Funston, R. V. J. Michigan State M. Soc., 1927, 26: 102.
10. Idem. Virginia M. Month., 1933, 60: 265.
11. Goff, C. W. New England J. Med., 1937, 216: 293.
12. Greene, C. C. Texas State J. M., 1935, 31: 270.
13. Henderson, M. S. Proc. Staff Meet. Mayo Clin., 1936, 11: 132.
14. Hermann, A. J. J. Bone & Joint Surg., 1937, 17: 709.
15. Hosford, J. Lancet, 1936, 1: 733.
16. Jaekle, R. F., and Clark, A. G. Surg., Gynec. & Obst., 1937, 64: 663.
17. Kessler, H. H. Accidental Injuries; The Medico-Legal Aspects of Workmen's Compensation and Public Liability. Philadelphia: Lea & Febiger, 1931.
18. Lenormant, C., and Wilmoth, P. J. de chir., 1932, 40: 1.
19. MacAusland, W. R. Surg., Gynec. & Obst., 1936, 63: 506.
20. McFarland, B. Brit. M. J., 1937, 1: 607.
21. Morrison, W. A., and Flamson, R. G. Surg. Clin. North Am., 1934, 14: 1459.
22. Reich, R. S. J. Am. M. Ass., 1932, 99: 1909.
23. Schofield, R. O. J. Bone & Joint Surg., 1936, 18: 566.
24. Spiers, H. W. J. Am. M. Ass., 1938, 110: 28.
25. Stewart, J. E. South. M. J., 1934, 27: 711.
26. Westhues, H. Zentralbl. f. Chir., 1935, 62: 995.
27. Yoerg, O. W. Surgery, 1937, 2: 493.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Calvet, J.: Bone and Joint Complications of Paratyphoid Infection (Les complications osseuses et articulaires des paratyphoïdes). *J. de chir.*, 1938, 52: 289.

Calvet reports 2 cases of osteoperiostitis due to paratyphoid infection, one paratyphoid-B and the other paratyphoid-A.

In the first case, the patient had had repeated attacks of pain in the left tibia since an attack of paratyphoid fever eleven years previously; this occurred at the site of an injury which the patient had sustained eight years before the attack of paratyphoid fever. The roentgenogram showed the middle portion of the tibia to be thickened; there was a small clear area in this region. At operation, a small cavity containing a little thick pus was found beneath the cortex. This was cleaned out and the periosteum closed. Paratyphoid-B bacilli were found in the pus. The patient made a good recovery.

In the second case, a swelling developed on the sixth rib on the right side while the patient was convalescing from a fever that had been diagnosed as typhoid; later, pain developed in the upper part of the tibia. These lesions were punctured and fluid was withdrawn; fistulas then developed. The tibial fistulas remained open for years; the rib fistula closed but a painful area remained. It was nearly fourteen years after the primary attack of fever that this lesion was curetted. Paratyphoid-A bacilli were found, and the patient was given specific vaccine by mouth. The lesion healed well.

The author has collected 16 other cases of osteitis and osteo-arthritis due to paratyphoid infection, which make 18 cases in all; but he does not claim that these are all the reported cases of paratyphoid osteitis. In a few of these cases the symptoms of the original febrile attack were severe; in others, as in the author's 2 cases, they were relatively slight. In some cases in children, it was difficult to obtain a definite history of fever of the typhoid type. While the initial symptoms of bone involvement usually developed within from fifteen days to two months after the febrile attack, it was sometimes years before the diagnosis was established and treatment instituted, as noted in the author's cases.

Paratyphoid osteitis and osteo-arthritis may occur at any age; most of the patients were between eighteen and thirty years of age. If the patient was a child, the lesion was more apt to be an osteo-arthritis; if an adult, osteoperiostitis. The long bones were most frequently involved, especially the tibia, and the ribs or vertebræ in some cases. Several of the patients showed multiple lesions.

Of the 18 cases only 2 (including the author's second case) were due to paratyphoid-A infection; 11 were due to paratyphoid-B, and 5 to paratyphoid-N. The N bacillus is distinguished from the A and B organisms only by its serological reactions; bone involvement with this type of the paratyphoid bacillus is more apt to be found in the flat than in the long bones.

Not all cases of paratyphoid bone involvement show definite suppuration; a lesion that is purely inflammatory at first may later become suppurative; this is the most usual type. In cases with multiple lesions, the various lesions may be of different types; some may subside without treatment, while others require surgical treatment. Paratyphoid osteo-arthritis usually shows an acute onset with swelling of the joints, pain and disability, and sometimes a slight fever.

Diagnosis of the condition is made on the basis of the clinical symptoms and history, aided by the roentgenographic findings. Definite diagnosis of the type of infection depends upon bacteriological study of the pus discharged through fistulas or obtained at operation.

In the treatment of paratyphoid osteitis and osteo-arthritis, surgical measures are usually required; they may consist of simple puncture, especially in osteo-arthritis. If there is suppuration, the cavity must be thoroughly exposed and cleaned, with removal of any sequestra. Occasionally more radical measures are required. In most cases, and especially in those with multiple lesions, it is best to combine specific vaccine therapy with surgical measures. The specific vaccine is given by Emile-Weil's method, four injections (¼, ½, ¾ and 1 c.cm.) in two weeks, then four more of 2 c.cm. each. Instead of the specific vaccine the combined typhoid-paratyphoid A and B (T.A.B.) may be employed.

ALICE M. MEYERS.

Coley, B. L., and Higinbotham, N. L.: Giant-Cell Tumor of Bone. *J. Bone & Joint Surg.*, 1938, 20: 870.

The causative factor responsible for the giant-cell tumor is still unknown. The authors believe that the traumatic theory offers the most logical explanation.

The giant-cell tumor is a solitary lesion with rare exceptions and is primarily an affection of the long bones. It is a disease of youth and early middle life. It originates in the epiphyseal region, and extends progressively with little tendency to destroy the adjacent shaft until late in its course. The most frequent sites are the femur, tibia, and radius. In a series of 385 collected cases these 3 bones were involved in 310 cases.

The opinions concerning the pathological changes in this tumor differ widely. Despite the advancement of many arguments that the giant-cell tumor is not a true tumor, its behavior and course reveal certain features that lead most present-day writers

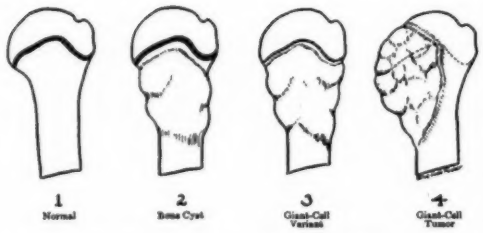

Fig. 1. Schematic drawing showing location, in respect to the epiphyseal line, of the involved area in bone cyst (2), giant-cell variant of bone cyst (3), and giant-cell tumor (4). Note especially the proximity of the process to the epiphyseal line in 3; also that the epiphysis is about to unite. Note also that in 4 the process involves the head rather than the shaft side of the epiphyseal line (now united), although it extends across to involve the metaphyseal area somewhat.

to regard it as such. It is difficult to conceive how a lesion that possesses the power of persistent growth and the tendency to recur after incomplete removal and to invade the adjacent tissues, and even in some instances to develop metastases, can be regarded as a chronic inflammatory process. The giant-cell tumor is usually benign, but malignant forms are encountered and may result from the transformation of a tumor that is histologically benign at the outset.

The first symptom is a "dull ache" which increases with activity. Disability most frequently occurs later in the disease, after the pain has been experienced, but often before the swelling appears. It is usually manifest in slight restriction of full range of motion of the nearby joint, and lameness after attempts at functional activity. Later in the course of the disease there will be evidence of increase in size of the tumor, interference with full range of motion, and, occasionally, increased surface temperature, and, in rare instances, pulsation of the thin shell covering the tumor.

The giant-cell tumor usually presents a characteristic roentgenographic appearance. It shows a destructive area in the epiphyseal region which involves adjacent metaphyseal bone, but which exhibits little extension to the cortical bone of the shaft. The area of involvement is irregularly spherical, shows trabeculations due to destruction of the cancellous bone, and tends to extend across the bone to destroy the whole transverse diameter before progressing shaftward. While it may extend to the cartilage of the articulation, it seldom invades it, and even late in the disease this structure remains intact. When erosion has progressed sufficiently to expand the cortex, it may later destroy it so completely that no evidence of a bony shell is seen in the roentgenograms, and only the periosteum remains as a limiting membrane. When pathological fracture occurs, it is apparent on roentgenographic examination, although marked displacement is unusual. However, the affected side of the bone is usually compressed, so that tilting is seen and irregularity of the joint surface is produced.

Three errors in making a diagnosis as pointed out by Codman are:

1. The films may be characteristic and yet the sections may be unequivocally in favor of some other diagnosis.

2. Both films and slides may be interpreted as giant-cell tumor and yet the rapid fatal course may indicate an error of interpretation.

3. The films, sections, and clinical course for several years may seem to assure the diagnosis and yet a sarcoma may eventually appear at the site of the lesion.

The question is not settled as to which is the better treatment, surgery or radiation. In general, surgery is preferable for accessible lesions, especially those situated in the region of the knee, and radiation for lesions that are inaccessible, especially those in the spine, the pelvis, or the neck of the femur. One should avoid the use of radiation and surgery in the same case. Borderline cystic lesions and true bone cysts are treated according to the same criteria and following the same principles. It should be remembered, however, that, since cysts are usually seen in individuals who have not attained full bone growth, the effect of the roentgen-ray on the adjacent epiphysis may result in retardation of growth and consequent bone shortening. This is of more moment in the lower extremity. Cases of advanced giant-cell tumor, in which the bony shell has been completely destroyed, are sometimes unsuitable for operation. Some of these have responded well to radiation.

The aim in all cases in which curettage is done is thorough removal of all tumor tissue and perfect healing of the wound. A twenty-four-hour skin preparation is advised. Protection of the wound edges with towels fastened with Michel clips is recommended. Uncontrolled bleeding may be forestalled by the use of an Esmarch bandage or tourniquet. Accurate hemostasis of soft tissue is essential. A large window cut in the cortex assures good exposure. The periosteum is preserved. The thoroughness with which the cavity is curetted is a measure of the probable successful result. The cavity is swabbed with zinc chloride and flushed with Dakin's or normal saline solution. The wound is closed layer by layer. Packing or drainage of the wound is strongly condemned. Firm, snug dressings of gauze-roll and sheet-wadding, held by flannel bandage reinforced with adhesive strips, maintain pressure evenly and help prevent wound infection by preventing hematoma. Elevation of the part for from forty-eight to seventy-two hours minimizes the swelling and prevents excessive oozing. The wound is not disturbed for a week. If the degree of involvement suggests the danger of a pathological fracture, protection by splints or by plaster casings is provided. Weight-bearing is avoided until regeneration of the bone is believed to be adequate. Motion of the contiguous joint is encouraged at the

TABLE I.—DIFFERENTIAL FACTORS

Factors	Bone Cyst	von Recklinghausen's Disease	Giant-Cell Tumor
Age	5 to 18 years	Young and middle-aged adults	Young adults (20 to 40 years)
Location	Metaphysis	Generalized, usually in shaft	Epiphysis
Bone involved	Upper femur, humerus, and tibia	Many bones	Lower femur, upper tibia, lower radius, and upper humerus
Fracture	Frequent (50 per cent)	Frequent	Less early, but in 25 per cent
Gross appearance	Multilocular, serous	Multilocular	Friable, reddish-brown, bloody
Appearance of tissue	Whitish	Fibrous	Reddish
Giant cells	Present	May be present	Plentiful
Vascularity	Slight	Avascular	Very vascular, even telangiectatic
X-ray appearance	Typical	Typical	Typical
Chemistry	Normal phosphorus, phosphatase, and calcium	Calcium and phosphatase elevated; phosphorus diminished	Normal phosphorus, phosphatase, and calcium

earliest moment possible. Caliper splints for tumors of the tibia and femur permit walking without danger of late fracture. This activity hastens bone regeneration. Appropriate splints are used for lesions in the upper extremity. It is not necessary to use bone chips, and it is unwise to fill the curetted cavity with them as has been recommended by some surgeons. Muscle and fat grafts are mentioned only to be condemned.

Resections and amputations are rarely indicated for primary tumors. These procedures are more frequently employed for complications following radiation therapy, such as radiation osteitis with fracture and non-union, ulceration, and infection.

Roentgen-ray therapy has many advantages over the use of the radium pack. It is more widely available, more economical, and a shorter time is required to deliver a comparable dose. No standard of technique for roentgen therapy has been generally accepted. The present tendency is to use smaller doses, to repeat the cycles less often or at longer intervals, and to withhold later treatment in the absence of symptoms and in the presence of a favorable roentgenographic appearance. The roentgen rays in large doses destroy the regenerative powers of the bone; in small doses, they may fail to arrest the disease; therefore, the exact dosage for the individual is a matter of profound judgment or of fortuitous circumstance, yet, where surgical experience in the treatment of this condition is lacking, roentgen therapy is the safer procedure. As a rule, however, regeneration and healing require a much longer period after radiation than after surgery, so that after the former the casts and braces must be worn over a much longer period. Protection during the regenerative phase is essential regardless of the treatment employed, for the pathological fracture usually spells functional impairment and a painful neighboring joint.

Surgery alone yielded the largest proportion of excellent results and the smallest proportion of poor results; radiation alone gave the next best; and combined surgery and radiation gave the poorest results. Coley's toxins were employed without any other treatment in 2 cases; in one the result was excellent; and in the other, good.

ROBERT P. MONTGOMERY, M.D.

Logròscino, D., and De Marchi, E.: Vascularization and Aseptic Necrosis of the Carpal Bones (Vascolarizzazione e trofo-patie delle ossa del carpo). *Chir. d. organi de movimento*, 1938, 23: 499.

The authors have undertaken the study of the carpal bones to investigate the numerous changes which they undergo following trauma and other factors.

Many possible causes of aseptic necrosis of the carpal bones are reviewed from the literature, among

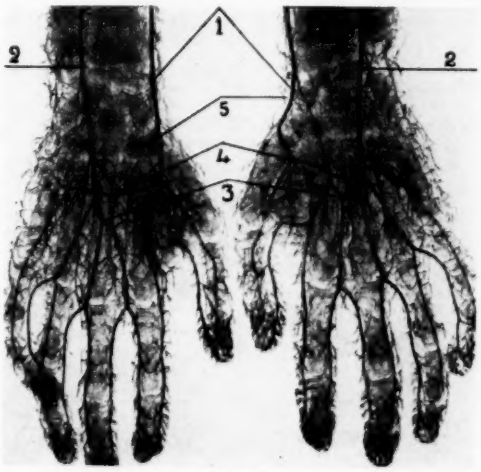

Fig. 1. Male, seven years of age. Roentgenographic preparation before removal of the soft parts. Note the difference in the vascular formation in both hands. 1. Radial artery. 2. Ulnar artery. 3. Superficial volar artery. 4. Volar profunda artery. 5. Dorsal artery of the wrist.

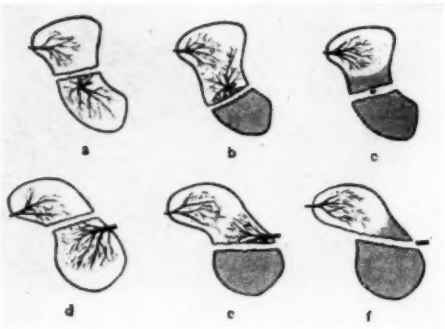

Fig. 2. Schematic presentation of an injected specimen copied from Lexer by Schnek. The figures represent the various types of fractures occurring in the scaphoid in the antero-posterior view (a, b, and c), and in the lateral projection (d, e, and f). The artery from the tuberosity is easily visible. If the fracture line runs between two areas supplied by different arteries, both fragments remain viable (a-d). If the fracture isolates a fragment from its blood supply, the distal fragment undergoes necrosis if the wrist is not immobilized for a long time (b-e). If the fracture goes right through the zone of the entrance of the principal artery, and if, in addition, immobilization is insufficient, necrosis also occurs in a part of the other fragment (c-f).

which are trauma, gonorrhea, tuberculosis, syphilis, infections in the blood stream, and local infective processes.

Axhausen proposed the theory that the necrosis is due to a thrombosis of the nutrient vessels, but was unable to demonstrate it in serial sections. The majority of authors believe, however, that the thrombosis is secondary, and not primary, to trauma.

The literature on the subject is extensively discussed. Logròscino devised a method for study by isolating the brachial artery in a fresh cadaver, and then washing out the peripheral vessels with warm physiological salt solution. After the arterial tree is completely washed the radiopaque substance is injected under considerable pressure.

TABLE I

	Scaphoid	Semilunar	Triquestrum	Pisiforme	Trapezium	Trapezoid	Capitation	Enciform
Bones examined	43	51	19	15	23	19	20	21
Average number of foramina	11.7	7.8	13.4	16	21.9	8	19	21
Gradation as to the number of foramina	3	1	4	5	8	2	6	7
Average number of foramina on dorsal surface	6.9	4.7	9.6		7.7	5	8.7	8.8
Volar surface	1.7	2	3.3		7	1.69	6.4	10.1
Radial surface	3	0.7			6.9		2.6	2.8
Ulnar surface							1.2	

Table I. The average number of nutrient foramina for each surface are presented. Note that the semilunar has the least number of foramina. Next is the trapezoid, and the scaphoid which has a large surface area. In reality therefore the semilunar has the poorest blood supply, after which comes the scaphoid, and last the trapezoid.

The arteries of the carpal bones of 8 female and 12 male cadavers were injected with good diffusion of the radiopaque substance in half of the cases. A great variability was found in the arterial supply, and also in the number of tributaries and the caliber of the lumen.

Each of the carpal bones were examined in detail both by means of radiopaque injections and study of the dried specimens. Marked inconsistencies of the blood vessels were shown. Numerous roentgenograms of the different types of fractures, and case histories are presented. CARLO S. SCUDERI, M.D.

Lance, M., Girard, L., and Lance, P.: Osteoporosis and Osteomalacia of the Spine in Adults (Les ostéoporoses et malacies du rachis chez l'adulte). *Rev. d'orthop.*, 1938, 25: 385.

Lance and his associates note that osteoporosis of the spine in the aged is only an exaggeration of a normal phenomenon; the chief symptom is kyphosis. Osteomalacia causes considerable deformity and often severe pain increased by movement. In senile osteomalacia the roentgenogram shows a complete disappearance of the bony trabeculæ of the bodies of the vertebræ and of the ribs.

While the occurrence of decalcification of the spine in the aged has been recognized for some time, it has only recently been pointed out that a similar type of osteoporosis or slight osteomalacia may be present in adults earlier in life. At this age period, osteoporosis is associated with pain, while in aged persons there is no pain or only slight pain, unless actual osteomalacia is present. In younger adults unless the osteoporosis is the result of a trauma, the pain is always located in the dorsal thoracic or thoracolumbar region. In cases in which trauma precedes the onset of symptoms, the authors are of the opinion that the trauma reveals rather than causes the osteoporosis. Presenile osteoporosis may cause a kyphosis, but this is not limited to the upper part of the spine as is typical of senile osteoporosis, but involves the whole spine or is limited to the lower part of the spine; in other cases the only deformity may be a small gibbosity. In younger adults as well as in the aged a severe form of osteomalacia may develop; in such cases the deformity of the spine is marked and the patients are usually confined to bed.

At the end of the War and in the years that followed, in countries where the food supply had been much restricted, a form of osteomalacia due to starvation was observed, similar to that observed during periods of famine in India and China. This form of osteomalacia involves not only the spine but also other bones of the body. In the spine it causes kyphosis and kyphoscoliosis; the most important roentgenographic sign is an absence of ossi-

fication in the osteoid zone, and a considerable increase in its thickness and volume, a lesion considered pathognomonic of rickets. A study of the starvation diet of these patients shows the prolonged deprivation not only of vitamins and mineral salts, but also of proteins and lipids.

Definite diagnosis of decalcification of bone can be made only by biopsy and by roentgenographic study; as biopsy is difficult when the vertebræ are involved, the diagnosis of this condition in the spine depends upon roentgenography. If there is any considerable change in the form of the vertebræ and thickening of the intervertebral discs, this is an indication of osteomalacia rather than osteoporosis. Determination of the calcium, phosphorus, and phosphatase of the blood, is also of importance; in the types of osteoporosis and osteomalacia under consideration, there is usually a slight diminution in blood calcium and phosphorus, but an increase in the phosphatase. By means of roentgenograms and blood analyses, osteoporosis and osteomalacia in adults may be differentiated from tumors of the vertebræ and from other bone diseases which may be localized in the spine, such as Paget's disease, chronic arthritis deformans, and Recklinghausen's disease.

With regard to treatment, the best results are obtained by the administration of calcium and of some substance that aids the fixation of calcium, usually irradiated ergosterol. The authors give calcium in the form of calcium gluconate by subcutaneous injection, or in severe cases by intravenous injection. Pain is best relieved by the wearing of some form of rigid corset or cast; in aged patients, who do not tolerate constant pressure well, this support must be removable, either a celluloid corset or a bivalved plaster cast.

The cause of osteoporosis or osteomalacia of the spine in adults may be definite and prolonged deficiencies (deficiency of vitamins, lipids, mineral salts), as has been shown in the osteomalacia occurring in famines. Endogenous factors that interfere with the proper absorption and utilization of calcium and phosphorus are also important, including intestinal, hepatic, and renal disease. The rôle of the endocrine glands in such diseases of the spine is more difficult to evaluate, as general involvement of all the bones is more apt to occur in cases of endocrine dysfunction.

The authors present a tabulation of 13 cases of senile osteoporosis and 53 cases of presenile and adult osteoporosis, including cases collected from the literature and cases observed by themselves.

ALICE M. MEYERS.

Wilensky, A. O.: Osteomyelitis of the Pelvic Girdle. *Arch. Surg.*, 1938, 37: 371.

The pelvic girdle is made up of the sacrum and innominate bones. The latter consist of an outer thin plate of compact bone surrounding an interior mass of cancellous bone and no marrow cavity exists. The blood supply is poorest where the bone is thinnest, and in young persons it is most abundant in and near the centers of ossification or around the acetabulum. The generally poor blood supply probably explains the infrequency of pelvic osteomyelitis. When it occurs, it is most common in the acetabular region.

Clinically, osteomyelitis can be classified as primary, extensible, or hematogenous in type. The differentiation between the first two types, especially after trauma or surgery, is often difficult. The pathogenic origin of the hematogenous type is usually apparent. Primary osteomyelitis follows an open wound which communicates with the bone and is usually a fracture or gun-shot wound. Following the Kraske operation for rectal cancer and the excision of sacral dermoid cysts, primary osteomyelitis of the pelvis may develop.

Extensible forms of the disease are seen after suprapubic prostatectomy, in which palliative and conservative treatment suffices to effect a cure of the infection in the pubic bone. Only 2 cases of osteomyelitis of the pubis after symphysiectomy in obstetrical cases have been recorded.

Hematogenous osteomyelitis of the pelvic girdle is similar to that of other bones except for some factors peculiar to its location. The author records 12 cases in a total series of 346 cases of osteomyelitis of all types, an incidence of about 3.5 per cent. The pathological picture, pathogenesis, and mechanism is not distinctive, but the lesions in the pelvic bones show no regularity in size or location. In the pubis and ischium they vary from concentrated involvement of inconsequential segments to involvement of nearly the entire anatomical segment. In the ilium they are most often in the neighborhood of the acetabulum or along the crest. Periosteal lesions are as common as those which involve the entire thickness of the bone.

The general symptoms are similar to osteomyelitis elsewhere, those of a severe generalized infection, but the evidences of localized disease may be few or absent in the early stages. Roentgenograms are of no help during the first ten days. When local signs appear they vary with the segment of the pelvis which is involved. Osteomyelitis of the sacrum may point externally with marked local swelling, or internally with tenderness and swelling palpable on rectal examination. The sacro-iliac joint may be the site of the infection. With abscess formation, spinal meningitis or the cauda equina syndrome may appear. When the abscess is anterior to the sacrum it may extend down to the para-anal region, remain as an ischiorectal abscess, point up to the iliac crest, or extend out into the gluteal regions.

When the infection involves the flare of the ilium it may point inward or outward. Early perforation through the thin shell of bone is frequent and may prevent spontaneous healing until thorough surgical drainage is instituted. With involvement of the acetabular region, the exact localization of the process usually depends on roentgenological evi-

dence. The involvement may be intra-articular or extra-articular and is easily confused with primary disease of the hip joint or upper end of the femur. When abscesses form, they may point externally where they are readily drained, or internally where they can be detected by rectal or vaginal examination. Hematogenous osteomyelitis of the pubic bone is usually of a subacute type and is recognized late when abscesses develop in the space of Retzius or externally over the pubis or down into the perineum and inner upper aspect of the thigh. A chronic fistula in these regions may result. Secondary involvement of the bladder with pyemia, perforation, or stone formation may occur. When the ischium is involved, there is pain, tenderness, swelling, abscess or fistula formation; and the exact localization of the lesion depends on rectal, vaginal, or roentgenological examinations. The roentgen rays are invaluable in the diagnosis of pelvic osteomyelitis which usually is first demonstrable in from eight to ten days as a periosteal thickening. Osseous changes appear later and depend on the location and extent of the lesion.

The treatment of osteomyelitis of the pelvis consists mainly in the incision and drainage of frank abscesses, or the attempt to eliminate resulting sinuses. Radical operations are usually feasible only when the lesions involve the flare of the ilium, although recently radical resections of the sacro-iliac regions have been successfully accomplished. In general the mortality in osteomyelitis of the pelvic girdle is 12 per cent. CHESTER C. GUY, M.D.

Brailsford, J. F.: Brodie's Abscess and Its Differential Diagnosis. *Brit. M. J.*, 1938, 2: 119.

A series of 62 cases of chronic abscess of the long bones is presented. Twice as many occurred in male patients as in female patients. The duration of symptoms was from one week to thirty years from the onset until the case came to the attention of the author. Single bone foci were present in 45 cases, while the lesion was associated with multiple bone foci in 17 cases. Over one-third of the cases showed the focus to be in the lower end of the tibia, which is in contrast to recorded cases of acute osteomyelitis, in which the upper end of the tibia was more frequently involved. With few exceptions the primary lesion was in the metaphyseal extremity of the diaphysis extending to the medulla and rarely perforating the epiphyseal cartilaginous plate. The perforation occurred only in cases of tuberculous abscess.

In the majority of the cases, periosteal reaction was lacking unless "the abscess was large and involved the whole extent of the diaphyseal extremity."

The organism recovered at operation usually proved to be the staphylococcus aureus, although in 2 cases the bacillus typhosum was present, and in 5 of the 6 cases in children under five years of age the lesion was apparently secondary to a tuberculous infection elsewhere.

The symptoms were usually insidious in their onset with recurrent attacks of pain gradually increasing in severity. The pain was usually described as being boring or burning in character and was at times severe. The adjacent joint at times developed effusions with acute phases, in which there were hot and often fluctuating swellings in the affected limbs.

In patients whose epiphyses had not fused, roentgenograms revealed an area of cancellous destruction, extending from the epiphyseal growth cartilage toward the medulla. The boundaries of the destruction were not usually sharply defined but were demarcated by a surrounding area of bone of increased density. The whole lesion tended to be spatulate in shape. No sequestræ were noted. Staphylococcus infections rarely perforated the epiphyseal cartilaginous plate but after the epiphysis was fused, penetration of the epiphyseal region was present and the process even invaded the joint in some cases.

After surgery the bone defect persisted at times, for many years without recurrence of the infection, although the patients not uncommonly had attacks of pain in the region and undue redness especially after local injury. Periosteal accretions, when present, disappeared after the abscesses were evacuated.

The differential diagnosis between typical staphylococcus abscess, tuberculosis, gumma, endothelial myeloma, and acute and subacute pyogenic osteomyelitis is discussed at length.

ROBERT PORTIS, M.D.

Meyerding, H. W.: The Results of Treatment of Osteogenic Sarcoma. *J. Bone & Joint Surg.*, 1938, 20: 933.

In the period from 1909 through 1934, there were 216 cases of osteogenic sarcoma at the Mayo Clinic. In 187 cases tissue was available for microscopic verification at the time of the original diagnosis; in the remaining 29 cases the diagnosis was based on the clinical and roentgenological findings. The average age of the patients when they presented themselves at the clinic was twenty-nine and three-tenths years. There were 126 males (67.4 per cent) and 61 females (32.6 per cent). Trauma was a possible factor in 44.9 per cent of the cases. The average duration of the symptoms before the patients came to the clinic was ten and four-tenths months.

The tumors in the 187 cases were re-examined histopathologically and, whenever possible, the grade of malignancy was determined according to the method of Broders. There was a slight increase in the percentage of so-called five-year cures in comparison with those in the author's previous publications: the percentages in the papers published in 1921 and in 1935 were 16.5 and 18, respectively, while the percentage of five-year cures in the cases in which the diagnosis was proved microscopically for the entire period is 23.4.

When every painful bony structure is subjected to thorough roentgenological examination, bone tumors will be diagnosed earlier. When these early cases come into the hands of those experienced in diagno-

sis, in grading the degree of malignancy, and in unbiased choice of treatment, more limbs will be saved and more lives prolonged.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Royle, N. D.: An Operation for Paralysis of the Intrinsic Muscles of the Thumb. *J. Am. M. Ass.*, 1938, 111: 612.

The inability to oppose the thumb to the other fingers because of paralysis of the intrinsic thenar muscles leads to "flat hand" deformity.

The author describes an operation of tendon transplantation for the purpose of restoring the function of the thumb:

The sublimis tendon of the middle or ring finger is detached at its insertion and drawn out through an incision on the wrist. This tendon is then passed up the sheath of the flexor pollicis longus and brought out through an incision at the level of the metacarpophalangeal joint of the thumb. Here the bifurcated sublimis tendon is sutured to the short flexor tendon of the thumb and the opponens pollicis. The author advises the "living suture" method. The thumb is held in position of opposition and flexion for ten days; then motion is encouraged.

HARVEY S. ALLEN, M.D.

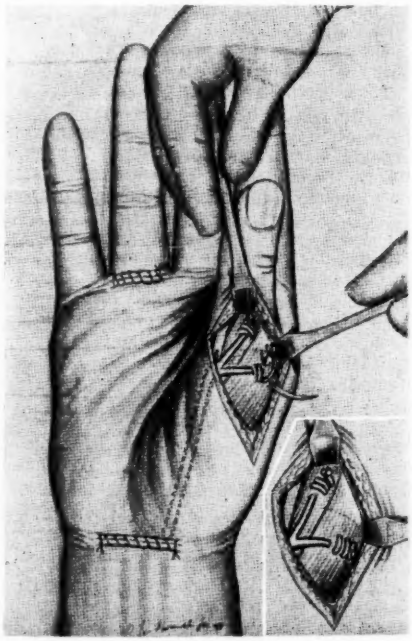

Fig. 1.

FRACTURES AND DISLOCATIONS

De Victoriis-Medori, F. The Process of Fracture Healing Following the Exclusion of One Kidney. Calcium Changes in the Blood Following this Procedure (Il processo di riparazione delle fratture in seguito all'esclusione funzionale di un rene. Il comportamento della calcemia in rapporto ad entrambe tali condizioni patologiche). *Policlin.*, Rome, 1938, 45: sez. chir. 297.

The author experimented with rabbits, fracturing the tibia and fibula of one leg and ligating one ureter. A series of animals were used both for experimental and control study, the controls being without ureteral ligation. The animals were killed at the end of five, ten, fifteen, twenty, twenty-five, and thirty days after the operation.

After the ligation of one ureter, the calcium content of the blood rose from the normal of 10 mgm. to 13 mgm. and returned to normal after fifteen days; which showed that calcium retention had occurred in most of the experimental animals.

The fracture produced in animals with a ligated ureter healed more rapidly than the fracture in the control animals. Theoretically, this more rapid callus formation in those animals in which the excretion from one kidney was disturbed, was due to the hypercalcemia of the blood with more rapid deposition in the fracture site.

The author gives an excellent bibliographical review of the subject. CARLO S. SCUDERI, M.D.

Blundell Bankart, A. S.: The Pathology and Treatment of Recurrent Dislocation of the Shoulder Joint. *Brit. J. Surg.*, 1938, 26: 23.

Recurrent dislocation of the shoulder joint is uncommon and is peculiar to athletes and epileptics.

The following alleged causes are based on an erroneous conception of the real pathology:

1. Abnormal laxity of the capsule
2. Fracture of the glenoid
3. Fracture of the humeral tuberosities
4. Deformity of the head of the humerus
5. Contracture of some muscles about the joint

The following operations which are performed for the cure of this disability are alike in that they ignore the real pathology and attempt to deal empirically with the resulting clinical condition:

1. Operations designed to diminish the size of the capsule
2. Operations designed to support the capsule by the placing of a sling of muscle beneath the joint
3. The Nicola operation and its modifications
4. Construction of a bony block in front of the head of the humerus.

The author states that recurrent dislocation is produced from an entirely different injury from the ordinary traumatic dislocation which is the most common of all dislocations of the joints. The ordinary dislocation is produced by a fall on the abducted arm which forces the head through the lowest and weakest part of the capsule between the sub-

scapularis muscle and the triceps muscle. When this type of dislocation is reduced the capsule heals completely and the dislocation never recurs.

The dislocation which afterward tends to recur is produced by a fall directly on the back of the shoulder or on the elbow which forces the head out of the joint by shearing the fibrocartilaginous glenoid ligament from its attachment to the bone. This defect remains permanent since there is no tendency for the detached glenoid ligament to reattach itself to bone.

The author has found this lesion at operation in 27 consecutive cases and he believes that this is the only pathological condition present in these cases. He has devised an operation to repair this defect. The glenoid ligament is exposed by the following technique:

1. A 5-in. incision is made from just above the coracoid process along the anterior margin of the biceps.
2. The coracoid process is divided with an osteotome and the detached portion is pulled down with the three muscles attached to it.
3. The subscapularis muscle is divided near its insertion into the lesser tuberosity and the anterior margin of the glenoid ligament is thus exposed.

The glenoid ligament is reattached with silk-worm gut passed through holes in the anterior border of the glenoid which has been freshened.

The arm is bandaged to the side with the elbow well forward. It is left in this position for one month, after which time active movement is begun.

The dislocation has not recurred in any of the 27 consecutive cases operated upon by this technique.

DANIEL H. LEVINTHAL, M.D.

Billiet, H.: Fractures of the Shaft of Both Bones of the Forearm (Les fractures diaphysaires des deux os de l'avant bras). *Rev. d'orthop.*, 1938, 25: 487.

Billiet discusses the important anatomical factors in the treatment of fractures of the bones of the forearm, and especially the arrangement and points of attachment of the muscles and their relation to the bones. He shows that the predominant action of the pronator muscles tends to increase the fragmentation in fractures of the shaft; and that muscle fibers are often interposed between the fragments. These complications occur most frequently in fractures of the radius, as is indicated by the position of the points of insertion of the muscles.

From a consideration of these anatomical factors, Billiet draws the following conclusions in regard to the treatment of fractures of the shaft of the bones of the forearm: this type of fracture must almost invariably be treated by surgical methods, not closed reduction. Operative reduction should usually be followed by some type of osteosynthesis. However, the author believes that osteosynthesis is necessary for only one of the two bones, the radius.

In the case of infants and children under five years of age the fractures are almost invariably subperiosteal, and operative treatment is not necessary. However, in older children, the fractures may be accompanied by fragmentation, and green-stick fractures occur, so that operative reduction is often necessary in children as well as in adults. Even in cases without marked displacement of the fragments, muscular fibers are apt to be interposed between the fragments, and interfere with perfect reduction of the fracture by closed methods.

Osteosynthesis may not be necessary in open reduction if the fragments are not much displaced, if their edges are smooth, and if the reduction can be made perfectly; but these cases are relatively rare. For most cases some form of osteosynthesis is necessary to hold the fragments in the correct position. Many French surgeons use plates fixed with screws, but the author prefers the clamps devised by Dujarier, which he uses almost exclusively in these fractures. These clamps require only two drill holes, and when the latter are correctly placed, the clamps hold the bone firmly.

While osteosynthesis is necessary in most cases of fracture of the shaft of the bones of the forearm, the author has found that it is not necessary to treat both the radius and the ulna by this method. The radius is the mobile bone; it is the one under most strain from the pull of the muscles; and it is also more closely surrounded by the muscles, which factors bring on the danger of the interposition of muscle fibers between the fragments. Experience has shown that fractures of the ulna heal well, either with perfect or satisfactory alignment after reduction; this is true especially if the fracture of the radius has been perfectly reduced with osteosynthesis. Pseudarthrosis of the ulna is rare, even without perfect reduction; the muscles attached to this bone are so placed that there is much less danger of interposition of muscle fibers between the fragments than in the case of the radius. The author has never seen an unsatisfactory reduction of the ulna in cases in which the radius has been perfectly reduced by osteosynthesis. ALICE M. MEYERS.

CORRECTION

Dawson, E. K., Innes, J. R. M., and Harvey, W. F.: Debatable Tumors in Human and Animal Pathology. V. Giant-Cell Tumor of Bone. *J. Laryngol. & Otol.*, 1938, 53: 491.

Attention is called to the above title of an abstract which appears on page 597 of the December, 1938, issue of the INTERNATIONAL ABSTRACT OF SURGERY. The Journal reference is incorrect and sh uld read: *Edinburgh M. J.*, 1938, 45: 491.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Martensson, K.: Results of Injection Therapy of Varices and a Clinical-Anatomical Study of the Relapses. *Acta chirurg. Scand.*, 1938, 81: 237.

Upon studying what has been written with regard to the results of injection therapy, the author finds that immediate results are nearly unanimously considered good. Opinions of the later results diverge widely, and few writers have taken into consideration all of the factors that influence the number of relapses.

The author presents his findings in a study of injection therapy, undertaken with a view to determining in what respects the reports of examinations made by other observers have been inadequate. He considers that the conditions of injection therapy are: (1) the changes due to the disease, (2) the resources of the injection therapy to cope with these changes, and (3) the effect of the respective injections.

The writer notes that when the disease has reached the phase at which it may be established by available diagnostic resources, there exist, during a certain period, conditions which are favorable to injection therapy. During this period, the varices are in their whole extent accessible to treatment, the endothelium is capable of reaction, the conditions of circulation in the part of the vein concerned are relatively favorable, and conditions for the working up of a new, sufficient system are also favorable. If the varicosities already existing in this period begin to spread, the conditions for a primary thrombosis grow less and less favorable, and if the main vein is reached by the insufficiency, there is still greater difficulty in the formation of a new, sufficient system.

Touching upon the results of injection therapy alone, the author notes that varices are to be looked upon as local symptoms of a disease of unknown cause. In the earlier stages it is characterized by degenerative changes in the walls of the vein. These result in vein insufficiencies. The varicosity is at first local, but sooner or later it progresses to more and more branches, and also proximally along the main vein. Possibly, too, it involves the connecting branches to the deep system. The further the disease progresses, the graver are the pathologico-anatomical and the pathophysiological changes; less favorable are the conditions for injection therapy.

Injection therapy attacks the disease by putting out of action the functionally incompetent veins by thrombosis. The formation of a collateral venous circulation is easy. A main vein that is blocked may be hazardous to the circulation, and the rapid formation of a collateral circulation is necessary.

The quality of the thrombosis is influenced by the conditions of flow in the vein-insufficiency, the incitability of the endothelium, the way the injection is given, and, possibly, the injected material. The injection therapy seems to give an effective and lasting cure of incompetent veins in some patients; in others there are relapses, and in still others there is no effect whatever. No one can predict in what cases, or in how high a percentage of cases any one of these results may occur. When the varicose changes are found to occur as high up as the saphenous-femoral junction, not even a thrombosis up to this junction will prevent a relapse. Conditions for a relapse exist from and including the ninth day and disappear about nine months after the thrombosis. True relapses have, however, been observed clinically two years after the treatment. They may have begun earlier although they did not become visible clinically until two years afterward.

To determine why, how, and in what cases relapses occur after a complete thrombosis, the author made a study of relapses of varices after injection treatment. The material studied consisted of 102 cases from Serafimerlasarettet. From this study, he observes that a causal factor in the occurrence of relapses after injection treatment is a centrifugal vein stream or reflux proximal to, or on a level with, the thrombus. Relapses have occurred as a result of the destruction of the thrombus, recanalization, or the formation of a passage. The filling up with blood that follows has been caused by a reflux, either direct or by way of an insufficient collateral from a proximal insufficient section of a vein.

Relapses also have occurred by the refilling of insufficient veins collapsed by blocking, but without thrombi. The cases in which relapses have occurred have been those of patients in whom the vein insufficiencies of the lower leg have spread to the thigh either as irreversible varicose degeneration or as vein insufficiency. Altogether, 55 such cases were registered and relapses have occurred in all but 2.

The cases in which relapses have not occurred have been those of patients with limited vein insufficiencies in the lower leg. There were 45 of these, and it is probable that in these injection therapy can arrest the progress of the varix disease. The relapses have, as a rule, occurred earlier and have been more complete in the cases in which only a smaller section had been thrombosed. All relapses have occurred between one month and about one and one-half years after the termination of the treatment. Relapses usually have been accompanied by an extension of the insufficiency, and this has been greatest and most marked in the cases in which only a small section has been thrombosed. It is probably the centrifugal vein stream, suddenly turned on at the destruction of the thrombus, that has been responsible for the occurrence. A fully satisfactory effect was obtained in the cases with limited vein insufficiency of the lower leg and in which the technique was easily accomplished. In the other cases

it was impossible to get complete thrombosis, partly because of technical difficulties and partly because of the risk. In one case with the gravest form of insufficiency the result was entirely negative. The results from this later study are well in keeping with what might be expected from examination of the conditions of the injection therapy reported in the earlier summary. HERBERT F. THURSTON, M.D.

Linton, R. R.: A New Surgical Technique for the Treatment of Postphlebitic Varicose Ulcers of the Lower Leg. *New England J. Med.*, 1938, 219: 367.

The distressing sequela of ulceration of the lower leg following deep phlebitis has been a problem in medicine for many years. Although the postphlebitic varicose ulcer may be healed after rest in bed, with or without skin graft, it was very often found that the skin grafts rapidly disintegrated soon after the patient became ambulatory. Extensive analyses of this condition suggested that the underlying cause for failure of the ulcer to remain healed lay in the veins which connect the deep venous systems of the leg with the superficial. These are known as the communicating veins, but are sometimes called the perforating veins. It has been shown that in the presence of incompetent communicating veins there is considerably more edema formation in the lower leg than when only the saphenous veins are incompetent.

The author published a detailed description of the anatomy of these communicating veins in a recent article. In this article he presents in detail the methods of preparation of patients with a postphlebitic varicose ulcer before ligation is done. Healing of the ulcer is secured by the patient being put to bed and the use of wet packs of warm compresses of 2 per cent boric-acid or saline solution. If the ulcer is too large to heal spontaneously, a Thiersch skin graft is applied to hasten the healing. When the skin graft has healed, the long saphenous vein of the affected limb is ligated in the groin. The patient is discharged with an elastic adhesive bandage applied directly to the skin from the toes to just directly below the knee. This is changed every two or three weeks. At the end of six weeks the patient returns to the hospital for the ligation of the communicating veins.

If the ulcer lies on the inner aspect of the lower leg, the medial group of communicating veins and the popliteal group of communicating veins are ligated. If it lies on the anterior surface of the leg, it is usually necessary to ligate the anterior group also. When the ulcer is on the posterior or posterolateral surface, the lateral group and the popliteal communicating veins are ligated and, in addition, the short saphenous vein is ligated in the popliteal space.

The author reports in detail a typical case of postphlebitic varicose ulcer which appeared eleven years after a deep thrombophlebitis of the right leg following a cesarean section. Despite numerous injections of sclerosing solution into the veins, the ulcer persisted. Following ligation of the long saphenous vein and the medial group of communicating veins of the lower leg, and obliteration of the long saphenous vein with injections of quinine-urethane solution, the ulcer has remained healed for nine months.

HERBERT F. THURSTON, M.D.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Murray, G. D. W., and Best, C. H.: The Use of Heparin in Thrombosis. *Ann. Surg.*, 1938, 108: 163.

Murray and Best have found heparin in its purified form to be non-toxic, and useful in instances in which intravascular clotting is likely to occur. These investigators found experimentally that this substance will prevent thrombosis, and their clinical results substantiate this finding.

Arterial anastomoses were accomplished with significant success in heparinized animals. Further, it was shown that if the vessel lumen remained patent for seventy-two hours, the suture lines had healed and there was no longer a tendency toward the occurrence of thrombosis. After a year only a slight scar was seen.

The authors pointed out that whereas peripheral embolectomy has been of no benefit after twelve or fifteen hours because the damaged intima initiates subsequent thrombosis, they were able to remove artificial emboli from heparinized animals after periods varying from twenty-four to seventy-two hours with satisfactory results. Thrombosis rapidly developed in their controls.

The transplantation of organs failed in all of the authors' cases in which it was attempted without heparin.

The purified form of heparin was found to be nontoxic to humans, and left no cumulative or residual effects. Clotting time raised to one and one-half hours returned to normal in an hour and twenty minutes.

The results obtained in cases of peripheral embolism have been encouraging. No amputations have been necessary, and in several patients there was a return and persistence of the peripheral pulse beyond the occlusion. The authors suggest heparin in cases seen too late for embolectomy, with the hope that it may prevent extension of the clot, and assist other measures used to restore the collateral circulation. It is also advocated for splenectomy, postoperative pulmonary embolism, phlebitis, and in blood transfusions, the donor being heparinized or the substance substituted for citrate.

Heparin is said not to dissolve a blood clot, nor will it initiate postoperative hemorrhage; however, its use is not advised within four to twenty-four hours postoperatively, since hemorrhage from vessels not bleeding previously, but following a rise in blood pressure, will be aggravated.

The administration of heparin is effected by the ordinary intravenous drip, 10 units of heparin being added to each cubic centimeter of saline. The average patient requires approximately from 25 to 30 drops per minute, the rate being governed by its effect on the clotting time, which should be estimated every few hours. The injection is discontinued when the patient resumes normal activity in bed, when the appetite is good, and when deep breathing is not uncomfortable.

The authors warn against the use of heparin in the presence of active hemorrhage.

ALTON OCHSNER, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Thorndike, A., Jr.: Trauma Incident to Sports and Recreation. *New England J. Med.*, 1938, 219: 457.

The author discusses the more common types of trauma incident to sports and recreation, such as contusions, sprains, and strain. The pathology and treatment of these conditions are similar, and early, adequate treatment for the control of internal hemorrhage in minor injuries is important. If the hemorrhage is slight, the hematoma to be absorbed will be small, there will be less fibroblastic scarring, and the period of disability will be shorter. A good end-result depends upon a prompt return of function, with a minimum of scarring. SAMUEL KAHN, M.D.

Lambret, O., Driessens, J., and Cornillot, M.: The Action of Infra-Red Irradiation on the Humoral Syndrome of Extensive Burns (Action de l'irradiation infra-rouge sur le syndrome humoral des brûlures étendues). *Rev. de chir.*, Par., 1938, 57: 478.

In their previous studies of the effect of extensive burns, Lambret and his associates have found that the chief factors are diminution of the volume of the circulating blood with diminution of the blood chlorides and acidosis, and hyperazotemia (resulting from proteolysis in the burned tissues).

In experiments on dogs, it was found that the application of infra-red irradiation to the burned area definitely kept the blood chlorides at normal level or even above normal. The effect of maintaining the blood volume was less marked, but the reduction in blood volume was never as marked in animals treated with the infra-red rays as in those with burns of equal extent not so treated. The effect of infra-red irradiation on acidosis was variable; it was more marked on the alkaline reserve than on the pH of the blood, but both tended to return to normal more promptly than in untreated animals. The effect of the infra-red rays depends upon the intensity of the irradiation and the extent of the burn. Infra-red irradiation reduced the polypeptides more markedly than the other nitrogen constituents of the blood. This effect was most marked at the time when in untreated animals the polypeptides were at their highest level.

The authors have had occasion so far to treat only 2 human cases of extensive burns with the infra-red rays. The first case was that of a woman, fifty years of age, with an extensive burn of the head, face, and neck. The characteristic changes, especially hypochloremia and acute acidosis (with diminution of both the pH and the alkaline reserve), were observed; but after treatment with the infra-red rays, these symptoms were much diminished at the end of twenty-four hours, and entirely relieved at the end of forty-eight hours, while in untreated cases, such symptoms became more marked in this period. In the second case, in which there was an extensive burn of the arm and shoulder, infra-red irradiation increased the blood chlorides, reduced the acidosis, and diminished the polypeptides of the blood, but did not entirely prevent an increase of the blood urea and amino-acids.

In its effect on hypochloremia and acidosis of extensive burns, the action of the infra-red rays is similar to that observed in postoperative shock. This effect is apparently due to the fact that the infra-red rays reduce the transudation of plasma from the vessels of the injured part (burn or operative wound) and thus prevent any marked loss of chlorides and bicarbonates, although it has not been demonstrated that infra-red rays reduce the permeability of the blood vessels. In postoperative cases infra-red irradiation has little effect on the increase in the polypeptides of the blood; but in burns this effect of the infra-red rays is very definite. In burns the infra-red rays apparently act directly on the polypeptides produced in the tissues, with the result that they are rapidly transformed into amino-acids, as is indicated by a slight increase of the amino-acids in the blood; but the amino-acids are immediately transformed and absorbed by the organism, hence they show no marked increase in the blood.

In experimental animals infra-red irradiation has a definitely favorable effect on the general condition. While untreated animals with extensive burns appear very sick, refuse food, and drink but little water, animals with equally extensive burns treated with the infra-red rays are much more lively and eat and drink normally. A similar effect on the general condition was observed in the 2 human patients treated by infra-red irradiation for extensive burns.

ALICE M. MEYERS.

Wangensteen, O. H.: The Surgeon's Rôle in the Treatment of Infection. *Wisconsin M. J.*, 1938, 37: 629.

More than any other factor, infection accounts for the surgical failures of the present day. Yet in the treatment of established infection the surgeon can accomplish nothing specific unknown to the preantiseptic period.

In localized infections incision and drainage are indicated but surgeons realize that incision of extending areas of virulent infection will not only do no good but will do actual harm. In spreading infections, the surgeon must do what he can to bolster the natural defenses of the body in their conflict against bacterial invasion. How this can be accomplished is a question yet unanswered. The use of antitoxins, sera, and immunotransfusions is undoubtedly of some value but it is difficult to establish the fact that it has improved the results of treatment in extensive or systemic infections. Recently a new drug, sulfanilamide, seems to be effective in many bacterial infections and is alleged to have a particular influence in hemolytic streptococcal infections.

Passive hyperemia has been a means of fostering the conservative treatment of infections. It is hard not to believe that the tissues may be more damaged than the bacteria by prolonged venous stasis. Aggravation of existing swelling exerts a deleterious influence on infection.

The author has not had enough experience with roentgen treatment of infection to assay its worth.

Of the various antiseptics, many have a distinct value but their chief merit would appear to be hastening the clearing up of an infection which has *already* become localized. They possess no value in localizing an infection. The host must still fight out the conflict with bacterial invasion with no specific help from outside sources.

The treatment utilized by the author for the management of acute pyogenic infections of the extremities is outlined. In this plan, the entire extremity concerned including the body trunk is immobilized in a plaster-of-Paris cast. The affected member is positioned in a cast in such a manner as to most favorably affect swelling by gravity drainage. Windows are cut in the cast to permit frequent scrutiny of the infected area. When there is definite evidence of suppuration, a small incision is made for evacuation of the exudate through a window. During the past two years this method has been employed in a large number of threatening infections of the extremities, including acute osteomyelitis, suppurative arthritis, phlebitis, lymphangitis, fascial space infections of the hand, and cellulitis. The only cases in which early incision is warranted are those of acute tenosynovitis.

The great importance of rest in the healing of wounds and in curing disease has been known for a long time. The immobilization which can be secured by the application of a spica plaster bandage to the body is ever so much more efficient than that obtained by any other method.

Wherein does the beneficial influence of immobilization lie? The relief of pain by the release of muscle tension is important. Further, the lymphatic channels through which the infection spreads lie in the fascia overlying the muscles. The lessening of muscle movement in plaster serves to obviate dissipation of the infection and is an important factor in aiding the natural defenses of the body in localizing the infection.

The rôle played by posture is probably equally as important. In part, its effect is the antithesis of that secured by Bier's hyperemia in which venous stasis increases tissue tension. Reduction of the swelling is

an important item in the treatment of infection and trauma. One inch of gravity, the author believes, is worth three weeks of physiotherapy in the reduction of swelling. Elevation of the extremity lowers the venous pressure and, consequently, the capillary pressure as well.

Lessening of the tissue tension assures the inflamed tissues of a more adequate oxygen supply.

The surgeon who uses conservative immobilization and posture will find that his patients will complain of less pain; that swelling will be more quickly reduced; that the necessity for incisions will occasionally vanish with the reduction of the swelling; that short incisions made for the evacuation of definitely established abscesses will do just as well as long incisions; and finally that with use of adequate immobilization and positioning of the extremity there will be less necessity for the external application of heat. Frequently the external application of heat is omitted entirely.

The value of this form of therapy is discussed in the treatment of acute osteomyelitis and suppurative arthritis.

In summary it is pointed out that the patient must himself fight out the battle with the invading organisms and that all the surgeon can do is to support the patient in the conflict. HARVEY S. ALLEN, M.D.

Sehrt, E.: Tetanus (Der Wundstarrkrampf). *Med. Welt*, 1937, p. 1773.

Tetanus is still a problematic sickness: it is controlled by the channels that circulate the toxin and antitoxin. After tetanus toxin is once firmly ensconced in the ganglion cells of the central nervous system, it is then irreversible. However, the changes caused by the toxin in the ganglion cells are reparable. The toxin travels exceptionally rapidly to the ganglion cells of the anterior horns of the spinal column along the lymphatics of the axis cylinders of the motor nerves. Only in the very early cases can the antitoxin counteract the toxin in the peripheral tissues, as the toxin travels faster than the antitoxin. Observations covering the blood plasma, the cerebral blood, and the membranes enveloping the blood of the brain are as follows: tetanus-antitoxin does not spread through the blood plasma, nor the membranes of the brain, but travels through the cerebral blood channels only. Is tetanus a spinal-cord, or a cerebral illness? Absolutely, the latter. The proofs are trismus and risus sardonicus (which are brain nerve symptoms); the rheumatoid pains located in the area of the original infection which no surgeon dares disregard; the local muscle contractions near the source of the infection; the fact that high division of the main nerve cord will stop these muscle contractions; and the possibility that the cramps may be controlled by means of acoustic and optic cerebral stimulation.

During the World War Sehrt was able to establish, by means of many sections, that in contrast to the usual negative findings, there always was a monstrous, almost strictly localized edema of the hypophysis and its contiguous area in these cases. This also proves that antitoxin circulates only by way of the cerebral blood vessels. The boundary level of this barrier lies in the capillaries, in the membrana limitans perivascularis of the cerebral vessels, and these are absent in the pituitary body, as proved by dye tests. This is an important point therapeutically; it shows that the intravenous injection of tetanus serum is the only efficacious method of treatment. The proposed method of injecting the serum into the subdural space, or into the lateral ventricles of the brain after trepanation is fallacious as the subdural space is firmly separated from the subarachnoidal space. Even if the injection would penetrate these spaces, it would have only a lumbar effect. The latter is justifiable only when the antitoxin is injected immediately after the infection, or, at most, during the first hours after the infection, by the lumbar route, in order to counteract the rapidly diffusing toxin before it reaches the cerebrum.

Sehrt appends an interesting clinical history: The patient sustained a skin infection of the thumb. This was treated to a certain degree, at intervals. The prophylactic injection was given seventeen hours after the injury. The initial maddening rheumatoid pains spread from the site of injury, and local muscle cramps ascended along the radius. After sixteen days dysphagia occurred, and, later, cramps of the abdominal musculature and then opisthotonos appeared. The patient was cured by means of 105,500 units of antitoxin given intravenously and 44 cgm. of morphine (given twice daily, 0.01 Morph. + 0.0005 atropin). The author recommends very high doses of morphine and states that tetanus patients are exceptionally tolerant to morphine. (He mentioned Pirquet, who in 1840 cured a case of tetanus with 250 cgm. of morphine within a period of five days.)

As a sequel in Sehrt's patient, there was unbearable pain in the cicatrix for four weeks: this was relieved only after exarticulation of the distal phalanx of the thumb. Although animal experiments with cicatricial tissues were negative, Sehrt believes he should mention that perhaps many pains are caused by tetanus infections, even though tetanus can not be demonstrated clinically.

An interesting feature of Sehrt's patient was the fact that during the tetanus illness there occurred a hypofunction of the thyroid gland with an increase during the attacks demonstrable by rapidity of the blood coagulation, and changes in the blood picture similar to those in eclampsia. Evidently the thyroid gland plays an important part in muscle cramps in both of these conditions. The author calls attention to the fact that the still prevalent opinion that tetanus serum has little curative effect in markedly developed tetanus is erroneous. The physician should not hesitate to give from 500,000 to 1,000,000 units of antitoxin. As a result of this treatment there were only 214 deaths (less than 50 per cent) in 438 cases of Yodhs (Bombay). Finally, Sehrt considers the daily heavy doses of morphine during the attack

absolutely superior to chloroform and probably also to avertin-narcosis.

(Franz). Mathias J. Seifert, M.D.

Toomey, J. A.: The Prognosis and Treatment of Erysipelas. *Ann. Int. Med.*, 1938, 12: 166.

Prior to 1926 the treatment of erysipelas was not specific. After the introduction of erysipelas antitoxin by Birkhaug in May, 1926, various reports appeared. It was claimed that with the use of antitoxin the general appearance of the patient became better, the temperature and pulse rate dropped, the length of time the patient was ill was decreased, there were no extensions, the toxicity definitely diminished within from twelve to eighteen hours after injections, there was a rapid disappearance or fading of the lesion and absorption of the pitting edema, and the mortality rate was decreased.

The author's report on the therapy of erysipelas is only preliminary, but it is sufficiently complete to enable him to state that his patients have not responded in like manner. Patients with uncomplicated erysipelas who had merely a localized lesion without extensions were ill from about two to fourteen days. The average was about seven days. The majority of the patients and controls in his series that recovered began to show improvement in their condition between the fifth and eighth days. Unless complications arise, it is unusual for the patient to be acutely ill longer than for this length of time. When spread occurs, it may take as long for the new lesion to clear up as the original one. Many patients are not sick for even a period of five or eight days.

Approximately 50 cases were treated experimentally with antitoxin and various amounts of prontylin (sulfanilamide) before the author finally began to treat erysipelas with this drug alone. All patients save those with hepatitis, increasingly severe nephritis, or sensitivity to sulfanilamide are now being treated in the following way:

The dose for the first twenty-four hours is computed on the basis of 1 gr. of sulfanilamide per pound of body weight. One-half of the total dose is given at once and the other half is given in divided doses over the first twenty-four-hour period. Each succeeding day, until the drug is discontinued, the patient is given ½ gr. per pound of body weight.

All but 2 patients have received this drug by mouth, and infants and patients in delirium are given it by means of the stomach tube. Two patients were injected with the drug subcutaneously. When the drug was injected subcutaneously, 75 gr. (5 gm.) were added to 625 c.cm. of saline, and the whole was given as an infusion. All such doses are modifications of those suggested by Long and Bliss. Rarely need this drug be given for more than four days unless there are local abscesses in addition to the erysipelas. Blood counts and hemoglobin estimations must be made daily and as soon as 400 gr. have been given, the patient should be carefully re-examined.

With antitoxin, the results were questionable save in the infant group. With sulfanilamide, they seem definite. Seventy-two of 76 patients thus treated with the latter have recovered and 3 have died, a mortality rate of 4 per cent.

With the use of sulfanilamide, the lesions of erysipelas become dusky red and purplish within the first twelve to twenty-four hours and disappear completely within from four to ten days. The inflammatory reaction is likewise gone and the patient is subjectively better within from twelve to twenty-four hours. No patient has had massive local desquamation following this treatment. The temperature comes down in a few days and usually by lysis. Only 2 of the patients had a spread of the lesion. However, there was only one spread in each instance and a very slight one.

The author concludes that if his experience with sulfanilamide becomes general, it will become the drug of choice in this condition. In patients with hepatitis or sensitivity to sulfanilamide, antitoxin may be tried on the basis that it can't do much harm and might do some good. John H. Garlock, M.D.

Snodgrass, W. R., Anderson, T., and Rennie, J. L.: Sulfamidochrysoidine, Sulfanilamide, and Benzylsulfanilamide in Erysipelas. *Brit. M. J.*, 1938, 2: 399.

This is the third of a series of articles on chemotherapy in erysipelas by Snodgrass and his associates at the Ruchill Fever Hospital in Glasgow. Each article has been based on a series of cases sufficiently large to allow the drawing of statistically significant conclusions, and in each series a measure of scientific control unusual in this type of clinical study has been employed.

In the first series of 312 cases it was shown that sulfamidochrysoidine (prontosil) in erysipelas was better than ultraviolet light for controlling the spread of infection, the duration of pyrexia, and the duration of toxemia. In the second paper the same conclusions were advanced for sulfanilamide when compared to ultraviolet light. In this third report the authors establish a scientific basis for the selection of a chemotherapeutic agent and dose in treating erysipelas.

Two hundred and forty patients were divided into 8 groups of approximately 30 patients each. Every patient in one group received 1.0 gm. of benzylsulfanilamide, and in a second group, 2.0 gm. of benzylsulfanilamide, every four hours. Four groups were treated with sulfanilamide, the doses being 0.5 gm., 0.75 gm., 1.0 gm., and 2.0 gm. four-hourly. The last 2 groups received sulfamidochrysoidine in doses of 1.0 and 2.0 gm., respectively, every four hours. Patients were assigned to groups in rotation as admitted. The results of these various types of treatment are tabulated with regard to the effects of each drug or dosage on certain aspects of erysipelas. Spread of the lesion was most rapidly checked by sulfanilamide, with sulfamidochrysoidine only slightly less effective. The duration of primary pyrexia

was about the same in each of the groups, about 75 per cent of the patients in each group having normal temperature within forty-eight hours. Duration of the toxemia was shortest when sulfamidochrysoidine was used, but the authors recognize the possibility that the slightly longer period of toxemia in the sulfanilamide groups might have been due to mild drug intoxication rather than to the disease itself. There were no recurrences with any of the drugs used, which finding was in contrast to the rather high incidence of recurrence among patients treated with other methods. The incidence of suppurative complications and thrombosis was only 6.6 per cent among the patients treated with sulfanilamide compared to 13.8 per cent in the other groups. The death rate in the entire group was 2.06 per cent, which is about one-fourth the average mortality rate of erysipelas in the Ruchill Fever Hospital for the period from 1931 to 1935, when chemotherapy was started. The incidence of toxic effects was far higher with sulfanilamide than with the other two drugs, but the authors have included mild cyanosis as a toxic effect, and this one factor accounted for most of the toxicity in the patients treated with sulfanilamide. The authors do not look upon cyanosis as a contraindication to continued therapy. They conclude that sulfanilamide or sulfamidochrysoidin may be employed with an approximately equal effect in erysipelas, but that benzylsulfanilamide is definitely less effective.

After taking into account all of the data, the authors recommend the following dose schedules: sulfanilamide 1.0 gm. every four hours until cure is established; then 1.0 gm. three times daily for fourteen days. With sulfamidochrysoidine the dose should be 1.5 gm. on the same schedule, with 1.0 gm. thrice daily for the fourteen days after recovery.

JOHN LOCKWOOD, M.D.

ANESTHESIA

Rocher, Philip, Got, Pouyanne, and Dupin: Anesthesia in Children (Les anesthésies chez l'enfant). *J. de méd. de Bordeaux*, 1938, 115: 33.

The authors sent out a questionnaire to surgeons, orthopedists, and otorhinolaryngologists in various countries, in regard to the choice of anesthetics employed in operations on children. The answers are divided into two groups: those furnished by general practitioners and those furnished by otorhinolaryngologists.

In the last mentioned group the majority of authors are opposed to general anesthesia in operations of long duration on the newborn or nursling.

Some surgeons employ local anesthesia, using ethyl chloride spray or a novocaine infiltration while others advocate nitrous oxide and oxygen or chloroform. The majority of workers are against general anesthesia, as they fear syncope and especially the so-called pallor-hyperthermia syndrome which, as its name implies, consists of a rise of temperature to 104.9°, pallor of the face, and complete prostration appearing from six to twenty hours after the operation, especially in an intervention on the face. Sometimes the symptoms subside but in the majority of the cases the temperature climbs as high as 107.6° and death ensues after from twelve to sixteen hours. In the course of this syndrome the alkaline reserve and the arterial pressure fall and a marked dehydration takes place. This syndrome never appears before the fourth day of life and is most frequently observed at the age of from six days to six months. Occasionally the same syndrome may occur after surgical intervention without any anesthesia. In reality the syndrome is due to a cardiac syncope.

Numerous surgeons abstain from the use of any anesthesia in children from one to five years of age if a short operation is intended, in order to avoid cardiac syncope and the danger of aspiration of the blood or lymphoid débris by the respiratory organs as a result of the loss of reflexes. Others use either heated or frozen ethyl chloride given through a tube or by a closed method. Interventions on the bronchi or the esophagus may be done under local but never under general anesthesia. Mastoid operations are performed most frequently under general anesthesia, supplemented, if so desired, by a retro-auricular infiltration with novocaine and adrenaline. Chloroform is used very generally by otorhinolaryngologists. In children from five to fifteen years of age a local or a combined local and regional anesthesia is becoming more popular. The older the child above five years, the more popular the local anesthesia.

Ethyl chloride and nitrous oxide share their popularity among the ear, nose, and throat specialists for operations of short duration, while for longer procedures chloroform, ether, balsoform, and nitrous oxide are used with approximately equal frequency.

As to the second group, the answers from general surgeons, there is a concurrence of opinion that the newborn should be operated upon without any anesthetic. In operations for conditions such as spina bifida and imperforate anus, local anesthesia may be employed. Hypertrophic pyloric stenosis also requires a local anesthetic, while a harelip is operated on under chloroform, by the intubation method. For older children ether is recommended by the great majority of surgeons, but some are using chloroform, Schleich's mixture, balsoform, and rectal ether anesthesia. The ratio of cases in which ether has been used to cases in which other methods, such as spinal, local, epidural, or rectal anesthesia have been used was 2:1.

JOSEPH K. NARAT, M.D.

Cordier, D., and Soulié, P.: The Influence of Some Basal Anesthetics on the Saturation Curve of the Hemoglobin and the Ether-Soluble Acids of the Arterial Blood During Anesthesia in the Dog (Influence de quelques anesthésiques de fond sur la courbe de saturation de l'hémoglobine et les acides éthéro-solubles du sang artériel au cours de la narcose chez le chien). *Anes. et anal.*, 1938, 4: 285.

Four types of anoxia may occur in the course of anesthesia. Anemic anoxemia appears in the anesthetized subject when the red cells are deficient in

numbers or are prevented from exercising their natural function. The action of volatile anesthetics on hemoglobin has been studied especially and a combination between hemoglobin and chloroform has been admitted, as well as the formation of methemoglobin, both of which decrease the respiratory function of the blood. Chloroform diminishes the affinity of the red cells for oxygen, and ether reduces the oxygen fixation speed of hemoglobin. On the other hand, the study of the respiratory function of the blood with regard to basal anesthetics has hardly been started; a decrease in the hemoglobin of the blood has been found in the dog anesthetized with avertin, and a slight anemia has been noted in man when he is anesthetized with evipan and avertin, while severe anemia has been reported in animals after several consecutive anesthesias with evipan.

The authors have used rectanol, narcosol, and evipan to study the saturation curve of hemoglobin in dogs and have determined at the same time the rate of total ether-soluble acids in the blood. The blood was obtained by arterial or cardiac puncture before and during anesthesia and was defibrinated before use. Rectanol (a solution of tribromethanol in amylene hydrate) was administered rectally in 2 dogs and intraperitoneally in 1 dog at high dosage; the determinations showed that this drug did not decrease the affinity of the red cells for oxygen and that the rate of the total ether-soluble acids was changed very little. Narcosol (a sodium derivative of ethobutylethylmalonyl urea) was injected intravenously in 1 dog and evipan in 2 dogs at high dosage; the determinations showed that these barbituric acid derivatives had only a very slight action on the affinity of the red cells for oxygen and that the rate of the total ether-soluble acids remained practically unchanged.

RICHARD KEMEL, M.D.

Goinard, P.: Regional Anesthesia by the Arterial Method (Anesthésie régionale par voie artérielle). *Anes. et anal.*, 1938, 4: 361.

The intra-arterial method of anesthesia is indicated for surgery of the extremities when other usual methods of anesthesia are contraindicated because of the presence of a grave pulmonary lesion, a hepatorenal lesion, or arterial hypotension.

A 1 per cent solution of novocaine has been used most satisfactorily for this method. The dose of novocaine varies between 20 and 40 cgm., according to the size of the superior or inferior extremity. The addition of adrenaline to the novocaine solution has been discontinued in consideration of extensive experience with such anesthetics.

The technique of injection is as follows: transcutaneous puncture of the artery or cutting down directly to the artery to be anesthetized is carried out proximal to the site of the operation. A constrictor proximal to the site of injection stops the venous circulation alone, or both venous and arterial flow may be stopped by greater pressure. A simpler method is to use two sterile pieces of rubber tubing at the extremities of the segment to be anesthetized.

The results obtained are very favorable. Anesthesia is complete within a few minutes and it is a true anesthesia, not an analgesia. The anesthesia lasts as long as the rubber constrictors are satisfactorily in place and even several minutes after the compression rubber bands have been removed. Postoperative pain in the member is practically unknown and many patients have been said to sleep the first night without a hypodermic or sedative. Troublesome postoperative hemorrhage or ischemia has not been observed after arterial anesthesia.

The effect of the novocaine upon the system as a whole when it is allowed to flow back through the veins is not unfavorable. The arterial blood pressure does not change, and there is no syncope; at most there is a slight intoxication with euphoria. There were no accidents, either local or general, in twenty-two months of observation. Several patients were subjected to this type of anesthesia several times.

The author wishes to emphasize the fact that arterial anesthesia, which has been found so efficient and so devoid of dangers, is not an anesthesia of minor importance; however, it should be used only in surgery of the extremities when all other usual anesthetic methods are contraindicated.

RICHARD J. BENNETT, JR., M.D.

Michon, L., and Frieh, P.: Technique for Anesthesia of the Stellate Ganglion (Technique de l'anesthésie du ganglion étoilé). *Anes. et anal.*, 1938, 4: 339.

Various routes have been employed for infiltration of the stellate ganglion with an anesthetic. Whichever route is selected, a long platinum needle, from 8 to 10 cm. long and 0.6 mm. in diameter, and a solution from 1/100 to 1/200 of a cocaine derivative are employed. A small amount of the anesthetic should also be used for anesthetization of the skin at the site of injection.

The anterior route for the infiltration of the stellate ganglion was first described by Leriche and Fontaine in 1934. With this technique the needle is introduced at the upper border of the middle of the clavicle in the direction of the apophysis of the seventh cervical vertebra. The authors consider that this technique is difficult, and does not always give a satisfactory infiltration of the ganglion. Puncture of the pleura is a possible complication.

The lateral external route was described by Goinard in 1936. With this technique the first rib must be located and the needle introduced in the region of the anterior border of the trapezius muscle at an angle of 45 degrees in the direction of the rib. This method, the authors note, may be carried out successfully in thin patients but is not suitable for obese or very muscular subjects.

The American school, represented by Adson, Brown, and White, employ the posterior route for access to the stellate ganglion. The posterior route has also been employed in France. Dreyfus le Foyer and Paraf, and Demarez have recently (1937) described their techniques for this method; Dreyfus

and Paraf employ the transverse process of the seventh cervical vertebra, and Demarez that of the first dorsal vertebra, as a guide for the introduction of the needle. The authors regard this posterior route as better suited for the infiltration of the thoracic chain than for access to the stellate ganglion.

A new technique has been developed by Leriche and Arnulf, who employ the supero-external route. The aim of this method is to follow the stellate ganglion with the needle along its longitudinal axis. For this method, it is important that the plane of the transverse processes of the upper vertebræ be determined by palpation, but it is not necessary that the transverse process of the seventh cervical vertebra be located exactly. The needle is introduced at a point approximately 5 cm. directly above the meeting point of the median and the inner third of the clavicle; this is usually at the angle formed by the external border of the sternocleidomastoid muscle and the external jugular vein; for a patient with a short neck this point is above the external jugular vein. The needle is introduced in a slightly oblique direction from above downward and from in front backward, until it contacts a vertebral transverse process, usually that of the seventh cervical. The handle of the needle is then inclined upward at an angle of 60 degrees. The needle is directed downward along the vertical axis of the transverse process, the anesthetic solution being injected continuously as the needle advances. The surgeon can introduce the needle from 8 to 10 cm., stopping occasionally, and aspirating slightly to determine whether any blood has entered the needle. Then from 10 to 15 c.cm. of the novocaine solution are injected. The needle is kept in place until the Bernard-Horner syndrome and hyperthermia of the arm and hand on the side of injection develop, which are signs that the anesthetization of the ganglion has been obtained. These phenomena are of short duration. In the removal of the needle a little more of the novocaine solution may be injected. The total amount used is 20 c.cm.

The authors consider this technique to be the most satisfactory as a rule; the introduction of the needle along the vertical plane of the transverse processes and in a slightly oblique direction from without inward gives good contact with the stellate ganglion

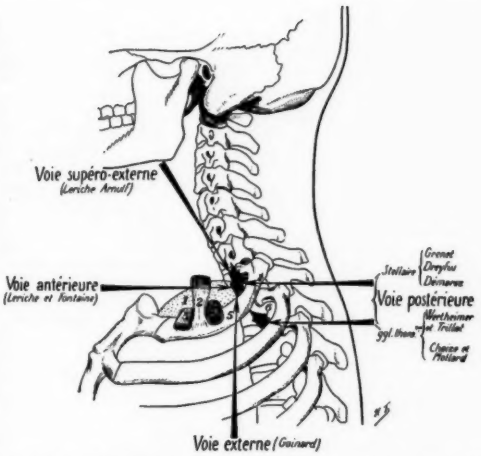

Fig. 1. Schematic illustration of the various routes of approach to the stellate ganglion and the upper thoracic chain. 1. The dome of the pleura. 2. The tendon of the scalenus muscle. 3 and 4. Subclavian vessels. 5. First rib. 6. Thoracic chain (upper thoracic ganglion).

and also with the innermost portion of the thoracic chain. The danger of any damage to important organs and vessels is reduced to a minimum; because of marked variations in its anatomical position, the pleura may be punctured, but this occurrence is more annoying than dangerous.

Whichever method is chosen for anesthetization of the stellate ganglion, it should be remembered that this procedure is a true surgical procedure; it cannot be carried out without all precautions used in major surgery. Each surgeon will probably choose the technique in which he is most experienced; but no one technique should be used in all cases to the exclusion of the others. The posterior route, for example, can be used to good advantage in dyspneic and asthmatic patients; the anterior route is best suited to thin patients with angina. In other cases the superior external route gives the best results.

ALICE M. MEYERS.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Leitner, Z. A.: The Physical and Biological Basis of Grenz-Ray Therapy. *Brit. J. Radiol.*, 1938, 11: 586.

Grenz rays are generated at from 6 to 12 kv. Their spectral distribution and intensities, both absolute and relative, vary with the voltage. Because of the softness of the radiation, the filtration of the air is of importance.

Because of variations in thickness of the Lindemann glass window, itself a filter, the relation of it to the air lying between the focus and skin is different for every focus-skin distance. It is, therefore, necessary to ascertain the quality of the rays for every focus-skin distance of every tube. This measurement is usually made in half-value layers of aluminum.

Grenz rays are absorbed almost entirely in the skin, and by taking into consideration the mean atomic weights of the different skin layers and their corresponding absorption coefficients, the author finds that their intensity is reduced to about 40, 20, and 12 per cent of the initial value through absorption in 1, 2, and 3 mm. of skin, respectively.

The action of Grenz rays in surface lesions is probably due to absorption of physical energy in the affected area, while their influence on distant or generalized conditions is probably secondary to an effect on the vegetative nervous system. Originally, Bucky believed that Grenz rays produced biological phenomena intermediate between those of the roentgen and ultraviolet rays.

The author has investigated the possibility of a correlation between the biological action of Grenz rays and their ionization of air, as measured with the Siemens dosage-rate meter equipped with a special Grenz-ray ionization chamber. There is not yet agreement on all points among the various workers but, in general, the biological effects of Grenz rays run parallel to the ionization of air.

Ionization figures as an index to erythema are variable for Grenz rays. Among 9 different authors, the figures varied from 100 to 1,380 roentgen units. The author irradiated with Grenz rays which were generated with 9, 10, and 12 kv. and used on small fields, the anterior forearms of 6 patients, and studied the reactions by frequent observations and the use of Wood's filter and the capillary microscope. He found erythema appearing as early as forty-eight hours after the application of 100 roentgen units. With increasing hardness of the rays, erythema is produced by smaller doses, this action apparently being a reflection of their deeper action. In comparing the appearance of the first erythema, it was found that the latent period decreases as the dose increases, the quality of the rays being constant. With doses of more than 2,000 roentgens, there is practically no latent period; with doses upward of 300 roentgens, usually a second wave appears; and with doses of 600 roentgens and upward, a third wave appears. The application of 700 roentgens is usually followed by desquamation, which is marked after 1,200 roentgens. The third wave of erythema is always followed by pigmentation, usually more marked than that which follows roentgen irradiation.

The quality of the rays is very important in the production of the main erythema, the wave being higher and longer for harder radiation; but it does not influence the latent period. The degree of erythema varies with each individual, the variation sometimes being pronounced.

The author repeated the investigations of Hausser and Schlechter on the degree of erythema following Grenz irradiation and obtained a similar flat curve for the early erythema. Both he and Wilhelmy, however, noted that the main reaction, occurring from four to five weeks later, shows a much more marked reddening, comparable to that of medium hard x-rays. It would seem, therefore, that there is only a quantitative difference between the x-ray and Grenz-ray curves of erythema, and not a qualitative one, as has been supposed since 1927.

Bucky and others have shown that the number of leucocytes in the peripheral blood is reduced by one-third in from ten to thirty minutes after Grenz irradiation, and that the original number is restored in from thirty to sixty minutes. A marked increase in the splanchnic area following the irradiation is probably responsible for this change, and the fact that no such response was obtained upon irradiation of a leg on which a sympathectomy had been done would substantiate this thought.

Grenz-ray irradiation does not change the amount of sodium and phosphate in the blood; it decreases the potassium considerably and the chlorine slightly, and increases the alkali reserve and the cholesterol, and the calcium slightly. There is an increased anionic deficit in the serum. *In vitro*, no change in the acidity after irradiation of the blood or protein solutions has been found. The blood sugar tends to fall.

Atrophy, telangiectasis, and pigmentation are the most common forms of damage. Kalz's data for the safe limits with rays of varying hardness were confirmed. However, despite wide use, not over a dozen cases of permanent damage are recorded. Permanent damage is caused not only by too large doses, but mainly by too early repetition of the treatment.

ADOLPH HARTUNG, M.D.

Ronneaux, G.: The Pulmonary Stratigraphy of Vallebona (La stratigraphie pulmonaire de Vallebona). *Arch. méd-chir. de l'appar. respir.*, 1937, 12: 442.

The term "planigraphy" is used in Holland, "tomography" in Germany, "radiotomy" in France,

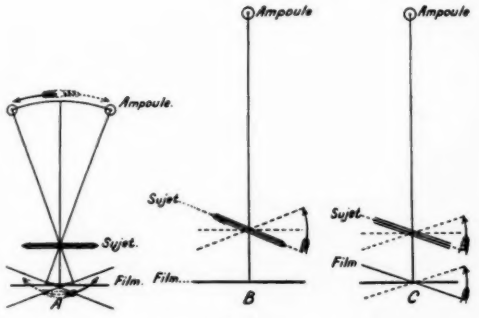

FIG. 1.

Fig. 1. (a) First method of Vallebona. The ampule and the film are displaced in inverse sense, around an axis passing through the "section" of the subject. The subject remains fixed.

(b) Second method of Vallebona. The ampule, placed at 2 m., and the film remain fixed. The subject oscillates around an axis passing through the subject in stratigraphing.

(c) Modification proposed by Bozzetti. The ampule, at 2 m., remains fixed. The subject and the film, which are parallel, oscillate at the same time.

and "stratigraphy" in Italy to signify roentgenological analysis of the organism by sections. This method is used for effacement of the parasite shadows and dissociation of the superimposed planes. It permits exploration and isolation of the successive cuts of the organs to be examined.

In the original method of Vallebona, both the roentgenographic tube and the film were displaced, the subject remaining fixed. In the second method of Vallebona, the roentgenographic tube is placed at 2 m. and the film remains fixed; the subject turns about a fixed axis (Fig. 2).

With modifications proposed by Bozzetti, the roentgenographic tube is at 2 m. and remains fixed; the subject and the film, which are parallel, oscillate at the same time (Fig. 1).

The French modification is the oscillo-strator of Ronneaux and Lemoine consisting of an oscillating platform on which the patient stands with his back supported against the mobile back to which he is fastened by straps. This permits advancing the patient between the uprights of a frame fixed on the axial plane of rotation in which one brings the "cut" of the lung which one desires to study. A film carrier is placed in front of the patient at a fixed distance of 30 cm. It is joined to the frame by an articulation which renders it solid while rotating. The whole operation of rotation and taking the roentgenogram may be controlled mechanically. A distance of 2 m., from 60 to 80 ma., and a time exposure of from 1/10th to ¼th of a second are used; an angle of 20 degrees has been found to be most satisfactory.

The value of the stereoscopic plates is not questioned but may be regarded as a complement to the

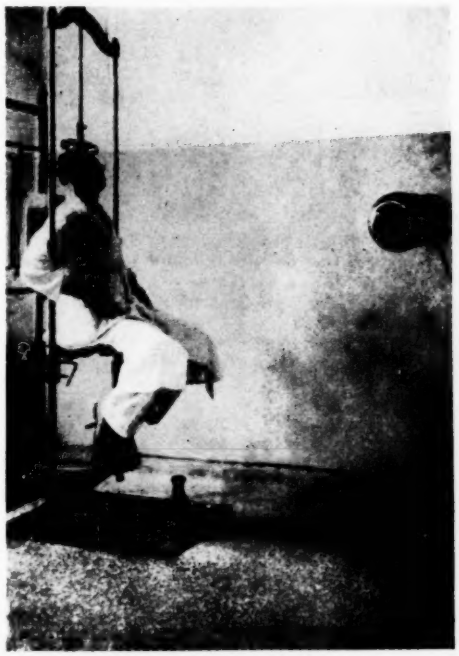

Fig. 2. The apparatus of Vallebona.

stratigraphy. The stratigraphy is above all an analytical method for the exploration of images and is of the greatest benefit when the clinical findings are in discord with the classical roentgenography.

Stratigraphy confirms the existence of cavity images of the apices of the lung. Lesions of the base of the lung and at the hilum, such as small areas of bronchopneumonia, unsuspected atelectasis, arterial intercrossings, bronchiectasis, polycystic images, congenital cysts, and air cysts, which may be invisible in the regular roentgenogram, are quite easily discovered with stratigraphy.

In certain cases in which half of the thorax is opaque and examination or diagnosis is therefore impossible, stratigraphy is found quite useful. In a study of a chest of this type, a fibrothorax which may have been thought complete proves to be only partial. Excavated lesions are ruled out and the presence of pulmonary infiltrations and of liquid or gaseous effusions is ascertained.

Stratigraphy is valuable in thoracoplasty for the study of the pre-operative conditions and the post-operative course. Sclerosis, pleural thickening, repair in sectioned ribs, and the like are shown quite well. When artificial pneumothorax is used the postoperative course may also be followed, and the adhesions and the condition of the cavity which was intended to be collapsed may be determined.

In abscesses of the lungs, the value of stratigraphy is rather inconstant. In tumors of the lung it may be of value for differential diagnosis.

Pulmonary diseases which will be benefited by stratigraphy are very numerous. This procedure is rather costly when several successive layers are taken, and should not be used except when the classical roentgenological diagnosis has not been satisfactory. This method does not supplant classical radiography, but there are many pathological lesions in which it is definitely indicated and in which it will be of value. It has the great advantage of being especially designed for roentgenological exploration of the lung in layers; it permits the use of simple material, is easy to handle, and may be used as an accessory in all existing roentgenological installations.

RICHARD J. BENNETT, JR., M.D.

Cottenot, P.: Results of One year of Seriescopy (Résultats d'une année de sériescopie). *Arch. méd.-chir. de l'appar. respir.*, 1937, 12: 434.

Tomography and seriescopy find their most important indications at the present time in the study of affections of the pleura and of the lungs. Roentgenograms often give incomplete and false images of suspected lesions. In seriescopy 4 successive roentgenograms are taken, which may be read at the same time when the depth of the different planes represented is known.

In one year the author has made 152 seriescopic examinations of the lungs. It was found that very few of the seriescopies were not usable in differential diagnosis. The diagnostic problems encountered and their results are discussed.

In the tuberculous lesions the findings were proved in a large proportion of the cases studied. Many suspected cavities were brought out definitely in detail.

Fig. 1. Abscess of the left lung; seriescopic section passing 3 cm. behind the anterior costal plane.

The seriescope has been of value in the differential diagnosis of a cavity from pleural thickening and the like. Images which have been impossible of interpretation by the usual procedures have been correctly diagnosed more often by seriescopy than by any other method. It has aided in the determination of the form, size, and exact location of a cavity with a view toward therapeutic intervention.

Seriescopic study of therapeutic pneumothorax has been shown to be of value in that the progress of the change in the lungs and of the pathological lesions of the lung have been followed with accuracy. The determination of adherent bands and cavities in the neighborhood of these bands has been successful.

Seriescopy has been of value in operative control by means of thoracoplasty. The change in size and location of the lesions and other alterations may be followed serially. In some cases of thoracoplasty in which the sputum is still positive it has been shown that a fibrous shell has not collapsed and is responsible for the still positive expectoration.

In the diagnosis of cancer of the lung, the seriescope has not given a great deal of help in the way of diagnosis, although in several cases neoplastic masses have been dissociated from the vasculohilar shadow with which they had been confused.

Twenty-one cases of abscess of the lungs have been studied. The size and depth of the abscess were determined in view of surgical intervention (Fig. 1).

The seriescope has in one year aided materially (1) in the diagnosis and treatment of lesions of the chest and most particularly in doubtful diagnoses, (2) in the exploration and location of lesions in view of surgical intervention, and (3) in the control of the results of therapeutic intervention.

RICHARD J. BENNETT, JR., M.D.

Garretto, U.: The Roentgenological Picture of Non-Calcified Muscular Cysticercus (Sul quadro radiologico della cisticercosi muscolare non calcificata). *Radiol. med.*, 1938, 25: 697.

The roentgenological demonstration of calcified cysticercus in the musculature of the human being is not uncommon, and is usually an accidental finding. The calcium is deposited in or about the cysts. The author studied a patient with a recent cysticercus infestation and believes that he was able to recognize the cysts roentgenologically before calcification had begun. He records the clinical history of the patient in detail and illustrates his descriptions with prints of roentgenograms showing the shot-like shadows representing the many cysts. The author believes that it was possible to distinguish the larval from the adult forms. The diagnosis was confirmed with biopsy. Roentgenological examination of the intestinal tract of this patient revealed a dysfunction probably due to the presence of parasites within the intestine.

Garretto notes that the patient died subsequently and necropsy was performed. Large numbers of

cysts were noted and there was no sign of calcification either in the musculature or in the soft parts of the trunk and extremities. A large number of parasites were found in the retroperitoneal fat. This localization may have influenced the function of the gastro-intestinal tract. A. Louis Rosi, M.D.

Barbieri, A.: Experimental Roentgenological Research on the Intestinal Tract of Ascaris (Ricerche radiologiche sperimentali sul tubo digerente dell'ascaride). *Radiol. med.*, 1938, 25: 745.

The explanation of the cause of the x-ray shadows noted in connection with the presence of ascaris within the intestinal tract has been the subject of much discussion. Illustrations are presented to show the various typical shadows. Those shadows which are noted in the study of patients who have not received contrast meals are usually the result of gaseous distention of the intestinal tract of the worm. Thus the worm appears as an elongated tube when visualized laterally and as a hollow disc or ring when visualized on end.

In patients who have received opaque meals the worms frequently are outlined by the same contrast substance which has gained access to the intestinal tract of the worm. The comparison of the shadows seen in patients with those produced experimentally in the isolated worms tends to corroborate the view that the ascaris imbibes radio-opaque substances. The intestinal tract thus outlined may appear as a relatively straight ribbon-like or rod-like tube. Occasionally the margins may be scalloped, probably as a result of segmental contractions of the intestinal tract of the worm. A. Louis Rosi, M.D.

Ungerman, A. H., Vicary, W. H., and Eldridge, W. W.: Luetic Osteitis Simulating Malignant Disease. *Am. J. Roentgenol.*, 1938, 40: 224.

Although syphilis affecting bone may exhibit definite pathological, clinical, and roentgenographic

Fig. 1. Fig. 2.

Fig. 1. Arrows indicate some of the lesions discovered at the first examination. Additional areas were shown in postero-anterior views in this and in subsequent examinations.

Fig. 2. Showing healing almost complete and first signs of bone production, indicated by periosteal thickening of the fibulæ, approximately seventeen weeks after treatment was instituted.

characteristics, such is not always the case. In many instances the final diagnosis must rest on the therapeutic test. The differential diagnosis from nonspecific osteomyelitis, periosteal sarcoma, osseous involvement with Hodgkins disease, and metastatic malignancy are discussed briefly. Stress is laid on the fact that bone production usually exceeds bone destruction in syphilitic lesions.

The authors report in detail a case in which certain of the usual clinical, pathological, and roentgenographic features of bone syphilis were lacking, and the impression gained was that of a malignant destructive process. Active anti-luetic therapy resulted in marked clinical improvement and subsequently the bone lesions presented a more or less typical roentgenographic appearance, characteristic of a syphilitic periostitis. Adolph Hartung, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Britton, C. J. C., and Howkins, J.: The Action of Sulfanilamide on Leucocytes: A Report on 50 Ambulant Patients. *Lancet*, 1938, 235: 718.

Serial leucocyte counts were made on 50 ambulant women who had received 21 gm. of sulfanilamide in fourteen days. The cases included normal controls, chronic cervical erosions without constitutional symptoms, chronic urinary infection with local symptoms only, and localized acute gonococcal infection. In 46 per cent of the cases a transient polymorph leucopenia was noted, and in 44 per cent a monocytosis. These changes were usually found between the seventh and twentieth day after administration of the drug. Toxic symptoms occurred in 70 per cent of the cases, but bore no definite relation to variations in the white count. The mild leucopenia observed is considered significant in view of the small dosage of sulfanilamide.

WALTER H. NADLER, M.D.

McCarroll, H. R.: The Regeneration of Sensation in Transplanted Skin. *Ann. Surg.*, 1938, 108: 309

The author discusses the regeneration of sensation in a series of 58 cases of skin transplant, 45 split-thickness grafts, 8 free full-thickness grafts, and 5 pedicle grafts. The patients ranged in age from five to fifteen years. The observations were first made five or six days postoperatively, continued daily for from one to two weeks, and, finally, made at weekly intervals until sensations in the area of the graft were equal to those of the normal skin. An algesimeter, accurately calibrated, was used for pain discrimination, and a wisp of cotton for touch. Pain and temperature observations were not considered accurate enough to justify reporting. Two-point discrimination was used in comparison of the graft to the normal skin. Previous observers had noted that the sensation returned from the margins toward the center of the graft, but, with the exception of the pedicle flaps in which sensation returned first along the proximal margin, the author noted simultaneous return throughout the area of the graft.

In 16 of the 45 split-thickness grafts sensation returned to that of normal skin in sixty days or less. The nerves apparently grow upward from the base, which accounts for the simultaneous return of sensation. The more dense the scar of the base, the slower is the recovery. If the sensory nerves were destroyed by deep burns, sensation sometimes never returned. If the nerve was destroyed to an area with sensory overlap, the return of sensation was better than in areas without overlap, as the forehead, in which no return occurred.

In the 8 free full-thickness grafts there was found a more rapid return of normal sensation than that reported by previous observers, but it was slower than the return in split-thickness grafts. With but few exceptions, in which the base was a very dense scar, the rate of regeneration was shown to be equal throughout the graft. In 5 cases approximately sixty days elapsed before sensation was equal to that of normal skin.

The results in the 5 pedicled flaps compared favorably to those reported by other observers. Sensation returned first along the proximal margin and that which was first attached to the new bed. Recovery in the body of the graft started from the proximal and lateral margins in 3 cases. Normal sensation had returned in an average of 285 days.

A definite time dissociation between the return of pain and touch sensation was noted, being more pronounced as the thickness of the graft increased.

BRADFORD CANNON, M.D.

Clarke, J. M.: A Brief Review of Functional Hyperinsulinism, with the Report of a Case. *Australian & New Zealand J. Surg.*, 1938, 8: 66.

The author reports a case of probable functional hyperinsulinism, greatly improved by partial pancreatectomy. The patient, a man of thirty years, complained of weakness which was relieved by food; however, the food, in turn, was apt to cause giddiness. He also complained of constant hunger, irritability, and of occasional tonic contractions of the flexor muscles of the ulnar aspect of the forearm. The lowest blood-sugar level recorded was 64 mgm. per 100 c.cm. The glucose tolerance curves were variable; with 50 gm. of glucose a maximum rise in the blood sugar to 148 mgm. occurred at one hour, while with 200 gm. of glucose a maximum rise to 96 mgm. was noted after two hours. Thirty-five grams of pancreatic tissue were removed. Studies of the sections of the gland are not reported. After more than nine months great improvement was apparent but the tonic muscle spasms of the forearm continued. The author believes that removal of more pancreatic tissue might have produced even better results.

WALTER H. NADLER, M.D.

Schroeder, E.: Five Cases of Primary Psoitis (Cinq cas de psoïtis primitives). *Acta chir. Scand.*, 1938, 81: 139.

Schroeder states that he was able to obtain the records of 5 cases of primary psoitis from various hospitals of Copenhagen, Denmark; 2 of these he has observed personally. Four of the patients were children under fifteen years of age; 1 was eighteen years of age; 3 were males; and 2 females. In a review of 36 cases of primary psoitis reported in the literature, the author found that 24 had occurred in children and 12 in adults; in 32 cases in which the sex was stated, 20 patients were males and 12 females.

In the 5 cases reported, there was a previous indirect trauma, a fall on the hip in 1 case; and a superficial infection (furunculosis) of the lower extremities which caused lymphangitis in another; no cause could be determined in the other 3 cases. One patient developed paratyphoid fever, but this was apparently an accidental complication, as the symptoms of psoitis were well developed before the onset of the intestinal symptoms, and the Widal reaction did not become positive until late in the disease.

The characteristic symptom of psoitis is flexion of the hip with inability to extend it, while other movements of the hip joint are not affected. In all the author's 5 cases, the left side was involved. As a rule the symptoms developed slowly; the patient began to limp, was unable to extend the hip, and complained of pain. Later the pain increased in severity, fever developed, and the patient was confined to bed with the hip in flexion. In 1 of the author's cases the onset was more acute with symptoms of general infection. The diagnosis was aided by roentgenographic examination, as this showed that the bone was not involved, and demonstrated the enlarged shadow of the psoas muscle. If intravenous pyelography is done it shows displacement of the kidney, as in 1 of the author's cases.

The milder cases of psoitis may be treated by hot fomentations and extension of the limb. If an abscess forms, as is usually the case, incision for drainage is necessary; the incision is made parallel to the crest of the ilium as a rule and the sheath of the psoas muscle is opened to give access to the abscess. ALICE M. MEYERS.

DUCTLESS GLANDS

Garlock, J. H.: The Differential Diagnosis of Hyperparathyroidism. *Ann. Surg.*, 1938, 108: 347.

In the twelve years that have passed since Mandl (at the suggestion of Erdheim) first removed a parathyroid adenoma in the case of a patient with hyperparathyroidism, the number of reported cases of this disease has increased considerably. Up to February, 1936, Wilder and Howell were able to collect 135 cases which, upon careful analysis, were unquestionably authentic instances of the disease. Undoubtedly, there have been many others which have not been reported.

The clinical, roentgenographic, and chemical aspects of hyperparathyroidism have been stressed so frequently in the past decade that the disease has become familiar to the medical profession at large.

It may be well, however, to again state that the various manifestations of hyperparathyroidism are dependent upon the secretory hyperactivity of one or more parathyroid adenomas which brings about a profound disturbance of the calcium and phosphorus metabolism, and that surgical removal of the tumor results in either complete cure or marked amelioration of the symptoms. The disease, which occurs more frequently in females and usually in middle life, is generally measured in terms of years. It is characterized by bone and joint pain, muscle weakness, localized bone swellings, pathological fractures particularly of the extremities and ribs, disturbances of gait, and, in advanced cases, deformities of the bones. There may be other symptoms which become so prominent as to cloud the more important aspects of the clinical picture. These are: attacks of intractable nausea and vomiting, polyuria and polydipsia, renal colic, anorexia, severe constipation, loss of weight, and secondary anemia.

The explanation of the roentgenological findings rests upon a knowledge of the disturbance of physiological activity of the parathyroid tumor. Normally, it is the function of the parathyroid bodies to control the calcium and phosphorus metabolism within the narrow confines of fairly constant blood-serum values of from 9.5 to 10.5 mgm. of calcium per 100 c.cm. and 3 to 3.5 mgm. of phosphorus per 100 c.cm. When parathyroid activity is increased, because of the presence of a hyperfunctioning tumor, the serum calcium level is increased and the phosphorus decreased, because greater quantities of calcium salts are withdrawn from the bones. Usually, increased phosphatase activity can be demonstrated. The effect of prolonged withdrawal of calcium salts from the skeleton becomes evident upon roentgenological examination. The bones of the skull present a finely granular appearance. The long bones appear porotic with thinning of the cortex and trabeculæ. There may be cyst formation in the center of the shaft. The pelvic bones are frequently cystic. The vertebræ present a coarsely granular pattern similar to that seen in the skull. As a result of a softening of the skeleton, deformities occur with the gradual collapse of supporting structures such as the spine, pelvis, and thoracic cage.

Up to the present time, most observers have agreed that a diagnosis of hyperparathyroidism should be made when, in addition to the clinical symptoms and roentgenological findings already enumerated, there is found a hypercalcemia, a hypophosphatemia, an increase in the serum phosphatase, and a proved negative calcium balance. In fact, the combination of these laboratory findings is considered pathognomonic of the disease.

The author reports 2 cases of proved hyperparathyroidism. These patients returned to normal health following removal of a parathyroid adenoma. In contradistinction to these cases, he reports in detail the history of a patient showing all the laboratory and roentgenological findings of hyperparathyroidism. No parathyroid adenoma was found and biopsy of an involved bone showed the case to be one of polyosteotic fibrous dysplasia, a condition described by Lichtenstein.

This disease is probably congenital, has a predominantly unilateral distribution, and affects primarily the medullary cavity.

The characteristic pathological features of polyosteotic fibrous dysplasia appears to be a disturbed function or development of the bone-forming mesen-

chyma, which results in replacement of the spongiosa and filling of the medullary cavity of affected bones by fibrous tissue in which trabeculæ of poorly calcified primitive new bone are developed by osseous metaplasia. The seemingly complex histological picture becomes much easier to interpret if one predicates the multipotential capacity of this undifferentiated fibrous tissue. The latter normally gives rise to the spongiosa and to the myeloid or fatty marrow, but under pathological conditions it may develop in several anomalous ways. By osseous metaplasia, it gives rise to osteoid and primitive fiber bone. By cartilaginous metaplasia, it gives rise to sporadic, isolated islands of hyaline cartilage which tend to become calcified. By fibroblastic differentiation, it gives rise to mature collagenous connective tissue. Finally, by coalescence of its nuclei, it may give rise to multinuclear cells, indistinguishable from osteoclasts. Whatever stimulates the continued perverted activity of the undifferentiated fibrous bone-forming mesenchyma, or initiates the disorder, remains a matter of conjecture. The clinical history of symptoms dating back to early childhood strongly suggests a congenital basis for this curious anomaly.

Finally, the author suggests that the surgeon, when confronted with suspicious bone lesions evident in the roentgenograms and with serum estimations of calcium and phosphorus which are outside the normal limits (in spite of the fact that calcium metabolism studies may show a negative balance), should not be too hasty to advise exploration of the neck for a parathyroid adenoma. It is suggested further that when doubt exists as to the diagnosis, additional investigation should be undertaken to clarify the situation. This consists of roentgenological examination of the skeleton to determine whether the bone lesions have a predominantly unilateral distribution, and the performance of a bone biopsy. The latter will definitely establish the diagnosis by differentiating the characteristic histological pictures of polyosteotic fibrous dysplasia from hyperparathyroidism.

De Donno, E.: Experimental Research on the Influence of the Prolonged Administration of Hormone from the Anterior Pituitary Lobe and of Prolan on the Vital Organs of Normal and Ovariectomized Animals (Ricerche sperimentali sull'influenza della prolungata somministrazione di ormone preipofisario e di Prolan su organi vitali della cavia normale e ovariectomizzata). *Ginecologia*, Torino, 1938, 4: 403.

The author lists a large series of isolated observations on the histological changes in certain organs following the administration of hormone from the anterior lobe of the hypophysis and prolan. The cortex of the suprarenal gland of the castrated female animal which received no treatment and was killed twenty-eight days after castration appeared normal. In the castrated female animal which received 1,400 units of prolan for twenty-one days and was then sacrificed, the suprarenal cortex was very much thickened; there was some degeneration and congestion of the cells, and the medulla was reduced in size. In the castrated animal treated with hormone from the anterior pituitary lobe, the modifications in the suprarenal gland increased proportionally with the amount of treatment. The cortex was thickened, vacuolated, and in some places even spongy. In normal animals treated with this hormone the changes in the cortex were not as marked as in the castrated animals.

The only series of animals in which there was significant change in the pancreas was that in which the animals were castrated and treated with prolan. In these animals there was degenerative change and vacuolization and after more prolonged treatment some congestion.

The liver undergoes the most marked changes in the castrated animals which are treated with the hormones. Changes in the lungs, heart, spleen, and kidneys are of less importance. A. Louis Rosi, M.D.